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South Australia.

A REVIEW

OF

MINING OPERATIONS

IN THE

STATE OF SOUTH AUSTRALIA

DURING THE

HALF-YEAR ENDED JUNE 30th, 1912.

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No. 16.

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Compiled by LIONEL C. E. GEE, S.M., Chief Registrar and Recorder, Department of Mines,

ISSUED UNDER THE AUTHORITY OF THE

HONORABLE RICHARD BUTLER, M.P.,

Minister of Mines,

By F. C. WARD, *Acting Secretary for Mines.*

DEPARTMENT OF GEOLOGICAL SCIENCES,
UNIVERSITY OF TORONTO

Adelaide:

R. E. E. ROGERS, GOVERNMENT PRINTER, NORTH TERRACE.

1912.

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Miners' Rights and Privileges thereunder.

A miner's right is obtainable at the Department of Mines, Adelaide, also at the issuing stations in the various mining districts, at a cost of 5s.

A miner's right is in force for one year from the date of issue, and may be renewed at any time during its currency for another term of one year on payment of 5s.

The holder of a miner's right is authorised to prospect on any mineral lands for any metal, mineral, coal, or oil, and to peg out (of the prescribed shape and dimensions) gold, mineral, coal, and oil claims, and also leases of a like nature.

AREAS AND WORKING CONDITIONS.

GOLD LEASES—Maximum area, 20 acres; working conditions, one man to every five acres.

MINERAL LEASES—40 acres; one man to every 10 acres.

MISCELLANEOUS LEASES—

Salt	640 acres;	special conditions.
Gypsum	640 "	"
Mining Works	10 "	one man.
COAL OR OIL LEASES	640 "	one man to every 40 acres.
GOLD DREDGING LEASES	200 "	special conditions.
MINERAL CLAIMS	40 "	
GOLD CLAIMS	30ft. x 30ft., alluvial; 100ft. x 600ft., reef.	

Gold claims must be constantly worked—one man for each claim—and mineral claimholders must employ two men for each claim. Amalgamation of either gold or mineral claims reduces the labor conditions by one-half.

Gold, mineral, coal, and oil leases are granted for a term of 42 years—the two former at a rental of 1s. per acre per annum and a royalty of 6d. in the pound on net profits, the latter at a rental of 6d. per acre per annum until coal or oil is found in payable quantities, when 1s. per acre is payable and a royalty of 6d. in the pound on the net profits.

The Minister may permit, for the concentration of labor, of the amalgamation of not more than four adjoining gold or mineral leases.

Any number of gold, mineral, coal, or oil leases may be held by one person.

Licences to search for twelve months for precious stones, mineral phosphates, oil, rare metals, minerals, and earths are issued on specific mineral lands, not exceeding five square miles in area for one person, a fee of 20s. being charged for each square mile or portion thereof. These licences give a preferential right to a lease over a portion of the area, as prescribed.

PREFACE.

The price of "Standard" copper for the six months has averaged £68 17s. 4d., or £11 16s. 1d. higher than that of the preceding six months, and, as overseas reports concerning the probabilities of a firm copper market for some time to come continue to be favorable, increased attention is being paid to our copper resources, and although, so far, the activity is hardly as great as had been anticipated, yet it is steadily growing.

Very little gold mining is in progress just now. The Tarcoola Blocks Company has found it necessary to suspend operations for the present; but good returns are being obtained from other small mines in the district.

Vigorous operations are in progress in the radio-active ore at Radium Hill, Olary, with, it is understood, satisfactory results; but at Mount Painter the developments, so far, are disappointing.

The salt scraping season has been a good one.

LIONEL C. E. GEE,

Chief Registrar and Recorder, Department of Mines.

August 19th, 1912.

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Mining Operations during the Half-year ended June 30th, 1912

AREA AT PRESENT HELD UNDER MINING ACTS (JUNE. 30TH, 1912).

Nature of Holding.	Number.	Area.
Mineral leases	239	11,503 acres
Gold leases	70	1,296 "
Gold dredging lease	1	100 "
Miscellaneous leases	41	8,638 "
Mineral claims	347	13,880 "
Occupation licences	180	90 "
Search licences	48	46,080 "
Coal claims	5	3,200 "
Gold claims	5	12 "
Total holdings	936	84,799 acres

REGISTERED FROM DECEMBER 31ST, 1911, TO JUNE 30TH, 1912.

Mineral claims	109	4,360 acres
Gold leases	4	80 "
Gold dredging lease	1	100 "
Mineral leases	27	1,040 "
Miscellaneous leases	1	63 "
Miners' rights	387	—
Search licences	20	12,800 "
Coal and oil claims	—	—
Gold claims	—	—
Total	549	18,443 acres

MEN EMPLOYED.

Estimated number of men employed in mining and mineral works, June 30th, 1912 :—

Copper	4,500
Gold	920
Salt	500
Silver-lead	30
Other minerals	550
Total	6,500

GENERAL NOTES.

The average price of standard copper for the six months is £68 17s. 4d. per ton, and the range of prices—lowest, January 16th, £62 9s. 3d.; highest, June 20th, £79 16s. 3d. The average for the year 1911 is £56 1s. 10d., and for the 10 years 1902–1 1, £63 12s. 3d. For the six months ended December 31st, 1911, the average is £57 1s. 3d., and therefore for the period under review the average improvement in price is £11 16s. 1d. per ton.

Notwithstanding this advance in value, and the encouraging reports from England and elsewhere as to the probable future firmness of the copper market, there is hardly as much activity in South Australian copper mining as had been anticipated. Holdings are, however, steadily increasing in number, and although no new finds of importance have been reported, a good many of the old places are being restarted.

The general prosperity of the country would appear to in some measure be answerable for the present lack of interest in prospecting. Men who can readily obtain good wages elsewhere do not care about working on back block mining shows or going out prospecting, and very few of the old type of prospectors, who never worked for wages, seem to be located in this State just at present.

At the *Moonta Mines* 16,598 tons of lode material were broken, and 14,658 tons of 2·5 per cent. ore (excluding precipitate) treated. From the *Wallaroo Mines* 57,926 tons broken and 53,926 tons of 3·46 per cent. ore (excluding retreatment and cementation) treated.

The report of the Government Geologist and Assistant Government Geologist on the *Yelta* and *Paramatta Mines* has been issued in pamphlet form, and the special report on these mines by Mr. Hartwell Conder, M.A., will be found on page 20 of this Review.

A report on the *Hamley Mine* will be found on page 41. Twenty-five and a half tons of copper have been produced from concentrates and slimes.

Four diamond drill bores, subsidised by the Government, have been put down at the *Cornwall Copper Mine*, near Kadina. No. 1 to 1,000ft; No. 1 to 600ft.; No. 3 to 398ft.; No. 4 to 339ft. Total—2,337ft. No developments of any value.

At the *Mount Lyell Consols Wallaroo Copper Mines*, previously known as the *Wallaroo Central* or *Bingo*, a power house and compressed air plant and pumps have been erected, and in April the sinking of a 12 x 5 shaft was commenced.

About 50 tons of lode matter have been raised at the old *Montacute Mine*, and the company has done about 150ft. of sinking, 150ft. driving, and 150ft. cross-cutting, cleaned out old drives and workings, timbered drives and shaft about 80ft., built blacksmith's forge, provided and placed in position hand pumping machinery, &c. For report on the property by the Inspector of Mines, *vide* page 36.

Work has been restarted at the old *Nuccaleena Mine*.

Only a little tributing has been done at the *Kapunda*, and nothing at the old *Burra Burra*.

The *Mount Gunson* Company has been reconstructed, and experiments as to the best method of treating the low-grade ore continue.

Preliminary and prospecting work is in progress at the claims near *Pernatty Lagoon*.

Returns show a little work in progress at the *Lux* on a 5 per cent. copper lode about 5ft. wide.

A small quantity of copper is being produced at the *Mutooroo*, mainly from the mine water.

Operations have been restarted at the *West Mutooroo;* the workings are being unwatered and cleaned up in order to investigate the deposits of sulphide ore there.

Tumby Bay Mine.—Sinking new shaft, driving in old workings, and getting out ore. A parcel treated averaged 11·20 per cent.

Nothing but general prospecting has been done at *Mount Rose.*

At the *Copper Queen* the Beltana Rapid Ore Syndicate is completing the plant and has treated 20 tons of ore for 1 ton of 70 per cent. concentrates. *Vide* report on page 43.

The men working at the old *Blinman* have raised 90½ tons of ore from the old stopes and along the line of lode on the surface, obtaining nearly 17 tons of copper.

A Government drill is at work on the *Mountain of Light Mine* near Leigh Creek. Full details will be found at pages 15 and 40.

Work at the *Deloraine*, near Kersbrook, consisted of shaft-sinking, driving, and stoping; also in installing and building in a high-pressure Cornish boiler 18ft. x 6ft., and erection of 5-head stamper battery with concentrating tables, water storage tanks, &c.

Stoping at *Kitticoola* has been in progress from the 180ft. level to the surface, and 1,112 tons of ore have been treated, by battery only, for 238ozs. 16dwts. 18grs. of gold.

The erection of the cyanide plant at the *New Medora* and *Mount Grainger* has been completed; 420 tons of tailings have been treated for 50½ozs. of gold. See page 39 for Inspector Jones' report.

Returns from the *Dustholes*, near Mount Grainger, show 12 tons treated for 13ozs. 16dwts. of gold. A Broken Hill Syndicate has taken an option over the property.

In order to assist the *Ajax Gold Mine*, in the Waukaringa district, now held by the Babylonian Gold Mining Company, many attempts have been made to find water in the vicinity of the workings, but without success. The Government has now therefore sunk a well near Simon's Well, about 3 miles to the N.E. of the mine, and struck an abundant supply of water at a depth of 40ft. A line of pipes will be laid to the mine, and the water pumped through.

Fifty-four tons of stone, treated by battery alone, at *Kirkeek's Treasure*, yielded 34ozs. 17dwts. 13grs. of gold. It is understood that this mine has been taken over by an English company.

A crushing plant has been erected on the *Virginia Mine, Wadnaminga*, by Mr. O. W. Allanson, and it is hoped that his enterprise will meet with the success it merits.

RADIUM HILL MINE, NEAR OLARY.

MAGNETIC SEPARATOR PLANT.

Faces page 9.]

Prospecting is in progress on the N. side of *King's Bluff*, and the sinking of the vertical shaft is still in progress at the *King's Bluff Mine*.

A start was made at unwatering the *Westward Ho Mine*, but owing to the bursting of boiler tubes, work was suspended.

At the end of March the *Tarcoola Blocks Mine* discontinued mining and milling operations for the present.

The mine is situated nearly 300 miles N.W. from Port Augusta, and, in consequence of the long carriage of all mining requisites, the expenses of working the property have always been very heavy, and now that no specially rich patches of ore have been forthcoming for some time back, the directors are forced into a "marking time" sort of policy until the East and West Railway, which will pass close to the mine, is available.

Gold was first found in the locality in 1893. Attention was called to the district by the Government Geologist's report of 1894, and the find of rich specimens which started the Tarcoola Blocks Mine was made in April, 1900, by some prospectors who were examining the country under agreement with Messrs. A. Tennant and C. H. Hakendorf. A battery was erected—the work of carting the boilers from Port Augusta to Tarcoola was quite a stupendous task—on May 16th, 1901, crushing was started, and from that time to the end of March, this year, 30,929 tons of ore have been treated, yielding 43,585ozs. of gold bullion, valued at £131,665, the average value of the stone being 85s. per ton.

Returns from the *Tarcoola Perseverance* for the six months show the treatment of 214 tons of ore at the Tarcoola Glovernment plant for 585ozs. 12dwts. of gold, valued at £2,200, or 205½s. per ton.

From the *New Glenloth* (*Fabian's No.* 3) 15½ tons treated at the Glenloth Government plant, yielded 65ozs. 12dwts. 3grs. of gold, valued at £205 0s. 3d., or 264½s. per ton.

Vigorous work is in progress at the *Radium Hill Mine*, near Olary, and 35 men are kept employed. The magnetic separator plant is working successfully, and the concentrates are forwarded to Sydney for treatment.

The Adelaide agents of the company, Messrs. Glynn, Parsons, & McEwin, have forwarded a copy of a notice dated July 1st, addressed to the shareholders by Mr. T. D. Jones, managing director.

"The following is a copy of a letter which was officially sent to the Sydney, Melbourne, and Adelaide papers on the 19th ultimo :—

> 'As forecasted in my letter to the shareholders of the 28th May, I have now much pleasure in stating that pure radium bromide has been prepared from our ore at our works at Woolwich, and will now take a month to fully mature, at the expiration of which it will be delivered to the purchaser with whom I made a sale for delivery in July.'

On the 28th ultimo we commenced smelting the concentrates at our works, Woolwich, and everything is now working smoothly and satisfactorily."

Radium Extraction Company, Mount Painter.—So far expectations have not been realised. The occurrence of radio-active ore has been demonstrated over a considerable area, small rich patches of torbernite and autonite are found, but no large deposit of ore carrying even a small regular percentage has been located.

The work done at the corundum locality has not as yet revealed any large bodies of corundum.

The *Iron Knob* quarries employ 40 men, and operations are carried on for the purpose of supplying the furnaces at Port Pirie with ironstone flux for smelting lead ore. Steps are being taken by the Broken Hill Proprietary Company to establish iron works in connection with this large deposit of iron ore ; but as it is cheaper to carry the iron ore to the coal than the coal to the iron ore, the works will probably be situated at Newcastle, New South Wales.

Asbestos.—Detail reports by the Inspector of Mines on the asbestos deposits in the hundreds of *Arkaba* and *Bright* are given on pages 44 and 45.

Salt.—The past season has been a good one, and it is estimated that 63,000 tons have been scraped.

COPPER.

AVERAGE MONTHLY PRICE OF COPPER, JANUARY TO JUNE, 1912.

	Standard.				Best Selected.		
	£	s.	d.		£	s.	d.
January	62	17	6	..	67	5	7
February	63	0	5	..	67	0	0
March	66	0	4	..	69	17	9
April	70	8	0	..	74	13	4
May	72	10	10	..	77	1	1
June	78	7	0	..	83	3	2
Average for the six months	68	17	4	..	73	3	6

RANGE OF PRICES—

January 16th	62	9	3
June 20th	79	16	3

AVERAGE PRICE OF STANDARD COPPER FOR THE LAST TEN YEARS.

	£	s.	d.		£	s.	d.
1902	52	8	3	1907	82	1	11
1903	58	3	2	1908	60	0	10
1904	59	0	7	1909	58	17	2
1905	64	16	10	1910	57	3	3
1906	87	8	10	1911	56	1	10

Average for the 10 years, £63 12s. 3d.

CRUSHING AND CYANIDING PLANTS.

RETURNS FROM GOVERNMENT CRUSHING AND CYANIDING PLANTS FOR THE HALF-YEAR ENDED JUNE 30TH, 1912.

Name of Mine.	Locality.	Weight Treated.			Gold Recovered.			Value of Gold.			Yield per Ton, in Shillings.
		Tons	cwts.	qr	Ozs.	dwts.	grs.	£	s.	d.	
PETERSBURG GOVERNMENT BATTERY AND CYANIDE WORKS.											
Homeward Bound ..	Mannahill	4	0	0	11	18	6	46	1	10	230/-
Dustholes	Oodla Wirra	7	16	0	8	3	21	29	19	9	77/-
Dustholes	Oodla Wirra	4	10	1	5	13	22	20	18	4	92½/-
Viking	Teetulpa	18	0	0	4	3	22	16	4	1	18/-
Mines	Petersburg ..... (Sand only)	40	0	0	1	5	0	5	0	0	2½/-
Total		74	6	1	31	4	23	118	4	0	32/-
Grand total since starting of battery ..		4,455	12	0	4,185	1	9	15,597	17	6	70/-

RETURNS FROM GOVERNMENT CRUSHING AND CYANIDING PLANTS—*continued.*

Name of Mine.	Locality.	Weight Treated	Gold Recovered.	Value of Gold.	Yield per Ton, in Shillings.
		Tons cwts. qrs.	Ozs. dwts. grs	£ s. d.	
MOUNT TORRENS GOVERNMENT BATTERY AND CYANIDE WORKS.					
G. Dumeyer	Woodside	5 0 0	0 17 8	3 0 2	
*Deloraine	Kersbrook.....	28 11 0	21 7 16	73 17 2	
G. J. Sampson	Woodside	5 12 0	1 2 13	4 7 7	
†Deloraine	Kersbrook	10 18 2	25 9 5	99 2 8	
Total.....		50 1 2	48 16 18	180 7 7	72/-
Grand total since starting of battery ..		9,948 13 3	5,870 13 17	22,238 7 10	45/-

* 1 ton 8 cwts concentrates worth 3 ozs. 9 dwts. 12 grains of gold per ton and 4·6% copper.

† 4 cwts. concentrates worth 8 ozs. 15 dwts. gold per ton and 1·3% copper.

The Petersburg and Mount Torrens Government Batteries and Cyanide Plants are worked alternate months by the one staff. For the 12 months ended June 30th, 1912, 316 assays have been made, 376 tons of tailings have been treated by cyanide, and 371 tons ore by battery, for a yield of gold valued at £1,094.

TARCOOLA GOVERNMENT BATTERY AND CYANIDE WORKS.

No. of Parcel.	Name of Mine.	Ore Treated.	Gold Recovered.	Value of Gold.	Yield per Ton in Shillings.
		Tons cwts qrs.	Ozs. dwts. grs	£ s. d.	
169	Tarcoola Perseverance.....	114 0 0	438 15 6	1,705 9 9	299/-
170	Government Mine Reserve.....	27 15 0	13 2 2	44 14 4	32/-
171	Government Mine Reserve.....	13 5 0	26 19 20	94 19 0	143¼/-
172	Day Dawn United	51 0 0	19 8 0	62 2 2	24⅓/-
173	Day Dawn United	25 0 0	32 9 4	75 9 4	60⅓/-
174	Day Dawn United	13 10 0	19 18 2	65 2 0	96½/-
175	Day Dawn United	5 15 0	2 6 3	7 1 3	24⅕/-
176	Silver Lead Mine	5 5 0	0 19 1	2 17 4	11/-
177	Curdnatta.....	26 10 0	19 17 9	66 11 2	50/-
178	Tarcoola Perseverance	100 0 0	146 16 18	494 10 11	99/-
179	Day Dawn United	102 0 0	56 14 21	132 0 0	26/-
	Total	484 0 0	777 6 14	2,750 17 3	113¾/-
	Grand total since starting of battery ..	3,157 0 0	4,539 3 15	16,015 6 10	101½/-

GLENLOTH GOVERNMENT BATTERY AND CYANIDE WORKS.

62	Fabian's No. 3 (New Glenloth)..	8 0 0	25 7 6	79 6 11	198½/-
63	Fabian's No. 3 (New Glenloth)..	7 10 0	40 4 9	125 13 4	335/-
	Total	15 10 0	65 12 3	205 0 3	264½/-
	Grand total since starting of battery ..	1,778 10 0	1,898 11 16	6,358 3 2	71½/-

RETURNS FROM CRUSHING AND CYANIDING PLANTS (OTHER THAN GOVERNMENT) FOR THE HALF-YEAR ENDED JUNE 30TH, 1912

Name.	Ore Treated.			Gold Recovered.			Value.			Yield per Ton, in Shillings.
	Tons	cwts.	qrs.	Ozs.	dwts.	grs.	£	s.	d.	
TARCOOLA BLOCKS COMPANY'S BATTERY AND CYANIDE PLANT.										
Battery treatment	382	0	0	490	0	0	1,180	0	0	—
Total	382	0	0	490	0	0	1,180	0	0	62
Grand Total since starting of Tarcoola Blocks Co.'s battery, May 16th, 1901, to	30,929	0	0	43,585	0	0	131,665	0	0	85
NEW MEDORA AND GRAINGER COMPANY, MOUNT GRAINGER.										
Tailings, Cyanided	420	0	0	54	10	0	154	0	0	—
Total	420	0	0	54	10	0	154	0	0	7
KIRKEEK'S TREASURE BATTERY, NILLINGHOO.										
Battery treatment	54	0	0	34	17	13	112	11	9	—
Total	54	0	0	34	17	13	112	11	9	42
KITTICOOLA, REEDY CREEK.										
Battery treatment	1,112	0	0	238	16	18	680	2	8	—
Total	1,112	0	0	238	16	18	680	2	8	12

TOTAL BATTERY AND CYANIDE RETURNS FROM ALL PLANTS FOR SIX MONTHS ENDED JUNE 30TH, 1912.

Name.	Ore Treated.			Gold Recovered.			Value.			Yield per Ton, in Shillings.
	Tons.	cwts.	qrs.	Ozs.	dwts	grs.	£	s.	d.	
Petersburg	74	6	1	31	4	23	118	4	0	32/–
Mount Torrens	50	1	2	48	16	18	180	7	7	72/–
Tarcoola	484	0	0	777	6	14	2,750	17	3	113¾/-
Glenloth	15	10	0	65	12	3	205	0	3	264½/-
Tarcoola Blocks	382	0	0	490	0	0	1,180	0	0	62/–
Mount Grainger	420	0	0	54	10	1	154	0	0	7/–
Kirkeek's Treasure	54	0	0	34	17	13	112	11	9	42/–
Kitticoola	1,112	0	0	238	16	18	680	2	8	12/–
Total	2,591	17	3	1,741	4	18	5,381	3	6	41/–

REPORTS ON BORING OPERATIONS.

BORING OPERATIONS AT THE WALLAROO EXTENDED MINE, KADINA, AND THE YELTA MINE, MOONTA.

Report by Mr. A. W. Matthews, Foreman.

No. 2 Bore.

(*Vide* Review No. 15, page 15.)

Wallaroo Extended lease was continued from 546ft. to a total depth of 898ft.

Details of Bore.

546ft.
to Blue country carrying small quartz and calcite veins.
578ft.
to Hard country.
588ft.
to Showing calcite.
589ft.
to Hard broken country, carrying seams of calcite, with occasional hard bars of quartzite. This country was all slightly mineralised.
898ft.

Dismantling the plant was started on March 4th, and carting and erection of same on the Yelta Mine completed on March 25th.

No. 1 Bore.—Yelta Mine.

Laid out to cut what is known as the tank shaft lode, at a depth of 500ft. vertical. The angle given the bore was 50ft. in 100ft. Boring started on March 26th, with 3½in. bit, and carried through surface loam and limestone to 12ft., at which depth standpipe was fixed. Boring was then resumed in very hard broken country, which, with the exception of three small seams of hematite, has continued to present depth—617ft.

Total boring for half-year, 969ft.

BORING OPERATIONS AT RAPID BAY.

Report by Mr. C. F. Duffield, Foreman.

No. 3 Bore.

(*Vide* Review No. 15, page 16.)

Boring operations at Rapid Bay were continued on January 9th, and No. 3 bore (position previously described) was put down to a depth of 400ft., the country passed through being as follows:—

122ft.
to Blue and white marble.
225ft.
to Blue marble, interstratified with thin bands of slate and a little pyrites.
245ft.
to White marble.
300ft.
to Broken marble, with small bands of decomposed ironstone.
340ft.
to Broken slate country.
370ft.
to Hard dark calcite rock.
400ft.

At this depth it was decided to discontinue operations, thus finishing the prospecting with the diamond drill at Rapid Bay.

Operations were stopped on March 2nd.

BORING OPERATIONS AT LEIGH CREEK.

It was then decided to remove the boring plant to Leigh Creek, to test the lodes at various depths on the Mountain of Light property, situated about 2½ miles S.E. from Leigh Creek.

The erection of the plant was commenced on April 22nd ; also a pumping plant fitted up near the old main shaft, and a pump put down to the 60ft. level, for forcing water to the bore for drilling purposes.

Boring operations were started at No. 1 bore, which is situated 180ft. S. of the main shaft, on May 7th, working one shift, and putting down an angle hole of 30° to cut the lode, which has a dip of about 45°, at 360ft. to 400ft. The country passed through being—

Surface
to Surface loam, coarse grit, and conglomerate.
40ft.
to Pink slate and sandstone.
54ft.
to Ferruginous sandstone, with quartz veins.
66ft.
to Hard broken limestone.
105ft.
to Limestone.
140ft.
to Pink slate and sandstone.
143ft.
to Pink slate, interstratified with bands of soft kaolinised matter and quartz veins.
167ft.
to Pink slate.
175ft.
to Sandstone.
180ft.
to Slate.
185ft.
to Sandstone, with occasional bands of quartzite.
196ft.
to Pink slate.
198ft.
to Sandstone.
227ft.
to Pink slate and sandstone of a friable nature.
249ft.
to Limestone (broken).
280ft.
to Solid limestone.
312ft.
to Pink slate, with veins of ferruginous quartzite.
320ft.
to Limestone.
325ft. Boring in progress.

We have experienced a great deal of trouble owing to the friable nature of the country in this locality, which continually grinds up and refuses to make good core. Pieces also frequently fall in from the sides of the hole, which will not stand long without being cased.

SUBSIDIES.

The Legislature provided in the Mining Act, 1893, and in previous measures for the encouragement of Mining.

The following schedule shows what subsidies have been paid from the inception of the system to June 30th, 1912, and the sums repaid. In the ordinary way these repayments are made from profits—50 per cent. of such profits being devoted to repayments. In two instances only have the profits won enabled full repayments to be accomplished—the Crystal Mine, at Echunga, which repaid £76 7s. 6d. from that source, and the once-famous New Alma and Victoria Mine, Waukaringa, which repaid in full the first subsidy, £3,000. The remainder of the recoveries was derived from sales of mining plant held as security. The total subsidies advanced is £56,181 0s. 9d. of which £6,779 1s. 11d. has been recovered, leaving a debit balance of £49,401 18s. 10d. Portion of this outstanding debt is represented by machinery that has fallen into the hands of the Government; add to this the value of the metals won, and the State in general will probably have benefited beyond the money value of the debit balance.

STATEMENT OF SUBSIDIES PAID FROM COMMENCEMENT TO JUNE 30TH, 1912.

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced.	Amount Repaid.
		£ s. d.	£ s. d.
Adelaide Crushing, Grinding, and Amalgamating Mill Co.	—	100 0 0	—
Algebuckina Gold Mining Syndicate	Algebuckina	52 10 11	52 10 11
Alma Extended Gold Mining Co.	Waukaringa	3,000 0 0	172 5 0
Backhouse, T. S.	Worturpa	100 0 0	—
Barossa Enterprise Gold Mining Coy.	Barossa, Hundred of	232 2 6	—
Belalie Copper Mining Syndicate	Bundaleer	392 12 3	—
Beltana Rapid Ore Treatment Syndicate	Near Beltana	209 18 6	—
Bevilaqua & Angel	Palmer (near)	57 18 0	—
Bird-in-Hand Gold Mining Co, Ltd.	Woodside	3,000 0 0	—
Blackfellow's Creek Gold Mining Co., Ltd.	Kuitpo, Hundred of	660 6 7	35 0 0
Callington Copper Mining Co.	Callington	148 8 7	—
Cockburn Copper Mining Co., N.L.	Mutooroo	273 18 5	173 13 8
Commonwealth Silver-lead Co., Ltd.	Strathalbyn, Hund. of	750 0 0	35 4 6
Copper Hill Mining Co., N.L.	Kadina	391 15 0	115 0 0
Cornwall Copper Mining Syndicate, N.L.	Kadina, Hundred of	500 0 0	—
Countess of Jersey Gold Mining Co., N.L.	Wadnaminga	321 0 0	—
Currency Creek Copper Mining Co.	Currency Creek	28 6 5	20 0 3
Crystal Gold Mining Co.	Echunga	563 17 6	176 7 6
Ding Dong Copper Mining Syndicate	Kanmantoo, Hund. of	124 0 4	—
Duke of Cornwall Gold Mining Syndicate	Mount Pleasant	458 17 4	43 10 0
Eagle Silver Mining Co, Ltd.	Glen Osmond	500 0 0	—
Echunga Proprietary Hydraulic Gold Sluicing Co., N.L.	Echunga	500 0 0	20 0 0
Ediacara Consols Silver Mining Co., N.L.	Ediacara	651 12 1	465 17 0
Enterprise Copper Mining Co., N.L.	Barossa, Hundred of	150 0 0	9 16 0
Enterprise Excelsior (Barossa Amalgamated)	"	2,000 0 0	—
Eureka Gold Mining Co., Ltd.	Woodside	1,500 0 0	—
Fifth Creek Central Silver and Copper Mining Co., N.L.	Fifth Creek	253 2 4	—
Fortress Hill Mining Syndicate	Fortress Hill	60 0 0	—
Glenloth Mining, Battery, & Options Co., N.L.	Glenloth	515 4 7	515 4 7
Glenloth Wells Pioneer Blocks Co., Ltd.	"	100 0 0	22 18 5
Gumeracha Gold Mining Syndicate	Gumeracha	75 0 0	—
Golden Point Claims	Wonna	50 0 0	—
Great Ironclad Gold Mining Co.	Teetulpa	218 6 9	—
Hakendorf, C. H., and Williams, J. (Glenmarkie Mine)	Glenloth	221 17 6	—
Hamley Copper Mining Co.	Wallaroo	2,000 0 0	—
Homeward Bound and Klondyke Gold Mines, N.L.	Mannahill	192 17 1	—
Hunter Bros. (Lady Millicent Mine)	Mochatoona	100 0 4	—

STATEMENT OF SUBSIDIES PAID—*continued.*

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced. £	s.	d.	Amount Repaid. £	s.	d.
Ireby Gold Mining Syndicate	Mount Grainger	35	4	3	—		
Kirkeek's Treasure Gold Mining Co.	Waukaringa	691	8	1	—		
King's Bluff G.M. Co., N.L.	Olary	368	11	4	—		
Kohinoor Gold Mining Co., N.L.	Kangaroo Island	100	0	0	—		
Kohinoor Mine (H. G. Taylor)	"	200	0	0	—		
Lady Alice Gold Mining Co.	Barossa, Hundred of	1,797	2	3	—		
Lady Franklin Syndicate	Port Lincoln	200	0	0	40	0	0
Leigh's Creek South Coal Mining Co., N.L.	Leigh's Creek	95	16	4	95	16	4
McMurtie's Claims	Kuitpo, Hundred of	199	19	11	—		
Medora and Grainger Gold Mines Syn., N.L.	Mount Grainger	921	9	9	—		
Mingary Gold Mining Co.	New Luxemburg	400	0	0	—		
Mount Victoria Mine	Bimbowrie	50	0	0	—		
Mount Malvern Silver Mining Co.	Blackwood	491	3	6	—		
Mount Malvern Silver-lead Mining Co., N.L.	Clarendon	1,347	15	3	—		
Mount Pangæus Gold Mining Co.	Hahndorf (near)	56	1	4	—		
Mount Monster Gold Mining Syndicate	Kuitpo, Hundred of	350	0	0	1	0	0
Mt. Grainger Ironclad Gold Mining Syn., Ltd.	Mount Grainger	21	18	10	—		
Mount Torrens Gold Mining Co.	Mount Torrens	1,000	0	0	—		
Mount Remarkable Mining Co., Ltd.	Wongyarra, Hund. of	122	8	1	—		
Musgrave Ranges Prospecting Association	Musgrave Ranges	47	2	0	—		
Mount Painter Corundum and Gem Syndicate	Mount Painter	47	3	1	—		
Morning Star Gold Mining Co.	Teetulpa	68	4	6	—		
Mutooroo Copper and Silver Mining Co., Ltd.	Mutooroo	500	0	0	500	0	0
Nackara Proprietary Copper Mining Co, N.L.	Nackara	100	0	0	—		
Nackara Proprietary Gold Mining Syndicate.	Nackara	100	0	0	—		
New Banksia Gold Mining Syndicate	Nairne	250	0	0	—		
New Alma and Victoria Gold Mining Co., Ld.	Waukaringa	3,000	0	0	3,000	0	0
New Ajax Consolidated Gold Mining Co., N.L.	"	750	0	0	—		
New Era Gold Mining Co., Ltd.	Woodside	1,000	0	0	—		
New Glenloth Battery and Mining Co., N.L.	Glenloth	750	0	0	—		
New Mingary Gold Mining Co.	New Luxemburg	250	0	0	—		
New Mount Grainger Gold Mines, N.L.	Mount Grainger	393	7	1	220	0	0
Northern Mining and Smelting Co., N.L.	Mount Fitton	350	0	0	—		
North Nairne Gold Mining Co.	Nairne	500	0	0	—		
North-West and West Australian Pros. Co.	North-west of S.A.	104	9	7	—		
North-West Prospecting Association, N.L.	Tarcoola	150	0	0	—		
Nil Desperandum Teetulpa Devt. Co., N.L.	Teetulpa	64	14	4	20	5	6
Nilpena Copper Mining Co., Ltd.	Blinman	290	5	3	—		
Onkaparinga Dredging and Mining Co.	Biggs' Flat	550	0	0	80	0	0
Paull's Consolidated Copper Propy., N.L.	Burr Well	525	0	0	5	0	0
Parara Mining Co., N.L.	Maitland	571	3	6	—		
Paringa Mining Syndicate	Callington	399	16	8	244	0	0
Paringa and West Kanmantoo Consolidated Copper Mine, N.L.	"	1,144	3	4	—		
Pioneer Gold and Copper Mining Syndicate	"	95	15	6	—		
Polmear, W. J. L.	Kadina	800	0	0	—		
Queen Bee Mining Co., N.L.	New Luxemberg	250	0	0	250	0	0
Quorn Manganese and Silver Mining Co.	Quorn	10	9	10	—		
Rapid Bay Silver Mining Co., N.L.	Yankalilla, Hund. of	136	2	4	—		
Royal Charlie Gold Mining Co.	Mannahill	153	18	5	—		
Rees, R., Ajax Mine	Waukaringa	604	14	5	—		
Stainbank, A. T.	Fifth Creek	70	14	11	—		
Sliding Rock Copper Proprietary, N.L.	Sliding Rock	2,000	0	0	24	2	0
Tarcoola Blocks Gold Mining Co., Ltd.	Tarcoola	3,995	5	2	—		
Tarcoola Enterprise Gold Mining Co., N.L.	"	100	0	0	19	10	4
Tarcoola Proprietary Gold Mines, N.L.	"	150	4	4	9	15	
Teatree Gully Gold Mining and Pros. Assn.	Teatree Gully	234	5	7	—		
Teetulpa Mining and Crushing Co.	Teetulpa	349	11	4	—		
Teetulpa Prospecting Syndicate	"	49	15	6	—		
Tumby Bay Copper Mining Co., N.L.	Hutchison, Hund. of	351	16	11	—		
Victoria Hill Amalgamated Gold Mining Syn.	Barossa, Hundred of	38	12	6	—		
Victoria Tower Mining Co., N.L.	Mannahill	345	18	9	90	0	0
Warrakimbo Propy. Copper Mining Synd.	Barndioota, Hundred of	220	16	2	—		
Warra Warra Propy. Copper Mines, N.L.	Farina	322	4	11	322	4	11

STATEMENT OF SUBSIDIES PAID—*continued.*

Name of Company or Person to whom Subsidy Granted.	Locality.	Amount Advanced. £ s. d.	Amount Repaid. £ s. d.
Watt's Gully Gold Mining Co.	Gumeracha	50 0 0	—
Watt's Gully Reef Claims	Gumeracha	50 0 0	—
Wolters, F. C., & Co	Echunga	25 0 0	—
Wallaroo Central Mining Co., N.L.	Kadina	500 0 0	—
Westward Ho Mine (Dr. H. Dixon)	Mannahill	1,000 0 0	—
Wohler, H., & Co.	Myponga	20 0 0	—
Wheal Turner Copper Mining Co., Ltd.	Prospecting on proposed line to Queensl'd Border	1,000 0 0	—
Winninninnie Gold & Silver Propy. Co., N.L.	Winninninnie	86 3 6	—
Woodside Boring and Mining Syndicate	Woodside	422 17 11	—
Worturpa Exploration and Mining Co., Ltd.	Worturpa	800 0 0	—
Yelta New Copper Mining Co, N.L.	Wallaroo	1,000 0 0	—
Young Bullfinch Gold Mining Co., N.L.	Talunga, Hundred of	138 11 6	—
Totals	—	56,181 0 9	6,779 1 11

ACCIDENTS IN MINES AND QUARRIES.

A gratifying feature of our mining operations in mines and quarries is the infrequency of serious accidents. Act No. 858 of 1904, bringing quarries in the same category as mines as regards the control, the Chief Inspector of Mines has been effective in safeguarding the interests of quarry-men. The following table gives the number of accidents in mines and quarries since passing of the Act:—

ACCIDENTS IN MINES AND QUARRIES.

Accidents in Mines.				Accidents in Quarries.			
Year.	Total Number of Accidents Reported.	Number of Persons Injured.	Number of Persons Killed.	Year.	Total Number of Accidents Reported.	Number of Persons Injured.	Number of Persons Killed.
1904	5	1	4	1904	1	1	1
1905	3	1	3	1905	—	—	—
1906	5	—	3	1906	1	1	—
1907	8	4	6	1907	3	1	2
1908	5	4	1	1908	—	—	—
1909	6	5	1	1909	1	1	—
1910	5	3	3	1910	2	1	1
1911	2	—	2	1911	—	—	—
Jan.-June 1912	3	2	1	Jan.-June 1912	2	—	2

ASSAYS AT SCHOOL OF MINES.

NUMBER OF ASSAYS MADE FOR PUBLIC PURPOSES AT THE SCHOOL OF MINES ASSAY DEPARTMENT DURING THE SIX MONTHS ENDED JUNE 30TH, 1912.

	1912.					
	January.	February.	March.	April.	May.	June.
Department of Mines	60	25	92	103	171	82
Public assays	53	46	143	82	75	72
Totals	113	71	235	185	246	154

DECENNIAL RETURN SHOWING OUTPUT AND VALUE OF VARIOUS METALS AND MINERALS PRODUCED IN SOUTH AUSTRALIA SO FAR AS CAN BE ASCERTAINED.

Year.	Gold.		Silver.		Silver Lead Ore.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Ounces.	£	Ounces.	£	Tons.	£	Cwts.	£
1902	7,231	24,878	—	—	2,680	19,740	136,937	388,162
1903	8,650	28,650	7,086	804	211	1,267	129,812	417,116
1904	17,897	76,025	—	—	—	—	125,560	382,356
1905	10,983	45,853	—	—	—	—	130,959	426,511
1906	8,037	27,000	801	104	—	—	164,160	718,609
1907	5,609	20,540	5,845	780	1,000	11,000	158,620	690,000
1908	2,908	12,300	—	—	900	9,000	112,554	338,000
1909	7,111	30,206	1,660	167	70	416	113,940	334,584
1910	6,603	28,000	6,250	625	25	22	102,040	306,120
1911	3,537	15,000	1,400	140	—	—	118,440	332,500
Totals....	—	308,452	—	2,620	—	41,445	—	4,333,958

Year.	Copper Ore and Regulus.		Lead.		Ironstone Flux.		Limestone Flux.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Cwts.	£	Tons.	£	Tons.	£
1902	2,579	42,550	43,507	22,303	—	—	—	—
1903	7,069	54,922	14,408	8,799	84,932	46,712	—	—
1904	3,051	24,597	—	—	46,687	27,091	43,440	6,516
1905	2,563	28,434	1,040	369	84,483	48,577	44,498	4,791
1906	—	—	1,000	550	75,226	33,852	31,940	4,791
1907	—	—	—	—	84,600	38,100	31,100	5,800
1908	—	—	—	—	88,000	39,600	29,500	6,000
1909	1,230	4,003	140	90	16,120	8,296	13,765	2,464
1910	—	*9,350	400	260	46,200	21,945	18,600	3,720
1911	—	*11,103	—	—	42,300	26,400	28,700	7,175
Totals	—	174,959	—	32,371	—	290,613	—	41,257

Year.	Phosphate Rock.		Crude Salt.		Other Metals and Minerals.	Total Value.
	Quantity.	Value.	Quantity.	Value.	Value.	
	Tons.	£	Tons.	£	£	£
1902.....	—	—	—	—	742	498,375
1903.....	1,000	1,000	40,000	12,000	100	571,371
1904.....	3,000	3,000	40,000	12,000	198	531,783
1905.....	5,000	5,000	32,500	13,000	1,261	573,796
1906.....	5,850	5,850	55,000	27,500	2,209	820,465
1907.....	8,000	8,000	75,000	37,500	2,500	814,220
1908.....	11,000	11,000	75,000	37,500	4,500	457,900
1909.....	3,772	3,697	51,407	25,594	3,873	413,390
1910.....	5,200	5,200	54,000	27,000	†13,600	415,842
1911.....	5,800	5,800	65,000	40,600	†11,319	450,054
Totals	—	48,547	—	232,694	40,302	5,547,196

* Bluestone, £5,980; Sulphuric Acid, £3,370.
" £4,163 " £6,940.

† Including Gypsum, £9,000; Pyrites, £3,270.
" £7,275; " £2,580.

REPORTS

BY

Mr. Hartwell Conder, M.A. (Camb.), A.R.S.M. (London).

THE YELTA MINE.

Situation.

This property is situated in South Australia, 133 train miles from Adelaide, and about one mile from the mining township of Moonta, which lies close to the waters of Spencer Gulf, 11 miles S. of the Port of Wallaroo.

A full account of the property is given in a descriptive and geological report issued by the Government Geologists, and published by the Department of Mines. The object of this report is to supplement that work by dealing with the economic position of the mine and the prospects of its financial success, and the matters dealt with thoroughly in the official report will only be briefly alluded to.

Geology.

The two lowest levels, the 1,080ft. and 1,200ft., were not clear of water, and were inaccessible. Considerable difficulty was met with in pushing down the water-level during the present inspection, and it is well that this work is nearly completed before the mine is called upon for its daily tribute to the furnace.

The country rock beneath a surface covering of travertine consists of massive felsite rock, crushed in places to schist, and with jointing developed in most parts. The lodes, of which there are many in the district, strike about N.E., and dip to the S.W. at an angle of about 60°, showing a consistency in this respect which is remarkable.

The lodes have been defined by the Government Geologists as pegmatite veins or dykes, a class of formation which is intermediate between the massive wall-like dykes of effusive rocks and the lode veins familiar to the miner. The lodes clearly correspond to this description, but it is not quite certain that all the quartz and copper sulphides were deposited simultaneously with the other constituents of the lodes. There is a marked distinction between the copper sulphide found distributed evenly through the hard felspathic rock that often fills the lode channel and the veins of rich ore which occur in many places with but little gangue, and usually close to one or other of the walls of the lode. These rich veins may have been introduced subsequently.

Of faulting there is little definite sign, but at the S. end of the workings broken country is met with that cuts off the lode at several levels. At No. 10 level, at the S. end, a small cross lode branches off at an angle of 25° from the line of the main lode, which becomes very indefinite. The data are not sufficient to decide clearly what has occurred, but the presence of these disturbances, and the failure of No. 6 level, which was advanced 200ft. S. to pick up the lode, make it appear probable that some lateral disturbance has occurred.

In the lower levels the lode rock is usually more solid and of finer grain, and the copper values are more evenly distributed throughout.

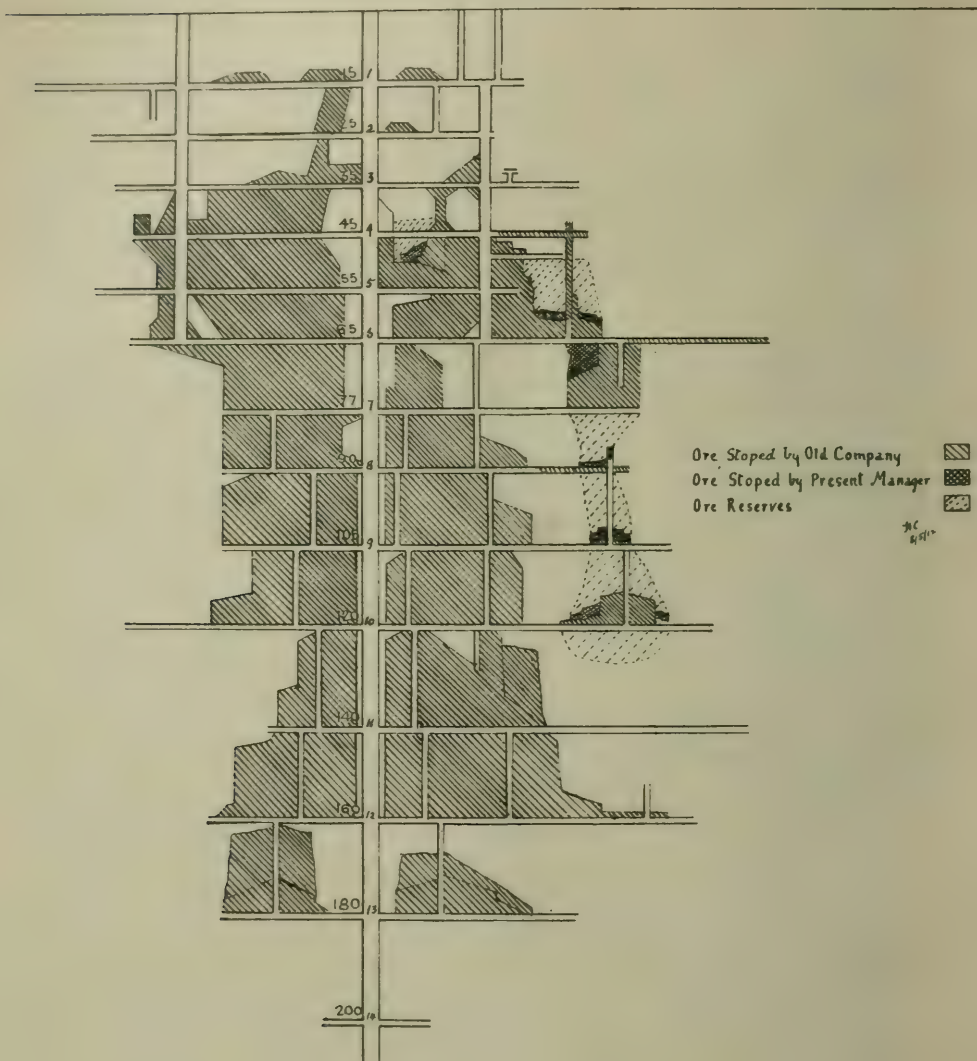
The ore is chalcopyrite, associated with a little pyrites, hematite, quartz, biotite, mica, and felspathic rock.

Economic Prospects.

In dealing with this aspect it is necessary to consider first the prospects of making profits from a certain quantity of ore of good value but limited quantity which has already been disclosed, and then to consider the prospects of providing further supplies when these are exhausted.

YELTA MINE

LONGITUDINAL SECTION OF UNDERGROUND WORKINGS.



A. VAUGHAN, GOVERNMENT PHOTOLITHOGRAPHER, ADELAIDE.

The position with regard to the known ore supplies is as follows :—The mine was opened up and the main shaft sunk 1,200ft. to prove and work what may be called the main shoot of ore. The shaft passed down through the centre of this, and levels were driven and the ore stoped out almost completely. While this ore was being worked out it was found that another shoot, called the South, existed further S. This was nearly worked out between the No. 7 (462ft.) level and the No. 6 (390ft.) level, and was exposed at the No. 9 (630ft.) level, and partly worked out at the No. 10 (720ft.) level. The present ore reserves are calculated from the ore between the No. 10 (720ft.) and No. 7 (462ft.) levels, and a certain area above the No. 6 (390ft.) level. A patch of ore has also been disclosed, left in the main shoot below the No. 4 (270ft.) level, and this may extend above the level for some distance as well.

The ore as exposed at these different levels was sampled and the results summarised. This sampling was extremely difficult : the lode rock where poor was very hard : where the values occurred it was soft and brittle. In chip sampling such a lode as this, however carefully it be done, the result is sure to be on the high side. Certain allowance has been made for this, and the results obtained coincide as closely as could be expected with such sampling of the broken ore as is practised on the mine.

The results of careful measurements and estimates for the different levels are as follows :—

Between No. 10 (720ft.) and No. 9 (630ft.) levels—Stope area, 4,068 sq. ft. ; width of lode, 3ft. 8in. ; tonnage, 1,243 ; value, 5·8 per cent.

Between No. 9 (630ft.) and No. 8 (540ft.) levels—Stope area, 3,960 sq. ft. ; width of lode, 3ft. 3in. ; tonnage, 1,072 ; value, 5·2 per cent.

Between No. 8 (540ft.) and No. 7 (462ft.) levels—Stope area, 3,744 sq. ft. ; width of lode, 3ft. ; tonnage, 936 ; value, 4·3 per cent.

Between No. 6 (390ft.) and No. 4 (270ft.) levels—Stope area, 2,988 sq. ft. ; width of lode, 4ft. ; tonnage, 996 ; value, 4·6 per cent.

Between No. 5 (330ft.) and No. 4 (270ft.) levels—Stope area, 342 sq. ft. ; width of lode, 3ft. ; tonnage, 81 ; value, 5 per cent.

The areas are shown on the accompanying section, together with the portions already worked.

The total tonnage amounts to 4,328—value, 5 per cent. ; to this might be added as almost proved 500 tons below the No. 10 (720ft.) level, and 200 tons above the stopes on the main shoot, just below the No. 4 (270ft.) level, making the total 5,028. The sampling from No. 4 level gave such poor results that no ore is included between this level and No. 3 (210ft.).

In a few cases in the measurements the full width of the lodes could not be seen and in other cases the limits possibly were hidden. In any case, it must be remembered that these estimates of lodes can only be regarded as approximations. In this case, as some general check on the above, we have the quantity of ore already mined from the stope area of 2,080ft. : this, on an estimate of 20 cub. ft. of broken ore to the ton, has given 1,485 tons, equivalent to a width of lode of 3ft. 9in. A greater width than this has been broken, but part of the rock broken was sorted out. The assay of the ore at the surface averages 4·9 per cent.

The weak point in the above reserves is the poor quality of the lode at the No. 8 (540ft.) level. Some of the other stopes, however, are very good, and the above estimates should be conservative.

Briefly there are available on the surface 1,125 tons ; underground, already broken, 360 tons ; underground, unbroken, 5,028 tons ; or a total of 6,313 tons of approximately 5 per cent. copper.

Smelting.

The above ore to be made profitable must be smelted, and the necessary plant exists on the property. It consists of two water-jacketted blast-furnaces with a hearth area of 8ft. 6in. x 3ft. and a column height of 17ft. To supply air to these it is proposed to use two No. 30 Baker blowers, while a Roots blower and another Baker blower are in reserve. An engine of 15in. cylinder, 2ft. 6in. stroke, running at 70 revolutions per minute, with boiler pressure of 75lbs., drives the blowers. The indicated horse power of this would be about 70, which should suffice for the moderate blast required.

The necessary boilers and circulating pumps appear in good order, and the water supply is assured. It is not proposed to run more than one furnace, though both have been made ready, and with one furnace a charge of from 50 tons to 55 tons of ore per 24 hours is contemplated. For this work the plant appears in every way adequate.

The ore itself should present no special difficulties. The majority of copper ores occur associated with silica and iron pyrites in varying proportion. Copper will unite with iron and sulphur to form a heavy fusible substance called matte. If too much sulphur is present in the ore the proportion of iron and sulphur in the matte becomes too great, rendering it bulky and low grade and future treatment costly. Hence ores with much iron pyrites in them require roasting first, to drive off the excess of sulphur and change the iron pyrites into iron oxide. The Yelta ore is low in sulphur, and requires no preliminary roasting.

Both silica and iron oxide are practically infusible by themselves. If they are present, though, in suitable proportions, they will unite together and form a fusible glassy substance, known as slag, which is lighter than the matte, and floats on it as oil floats on water, thus enabling the unprofitable components of the ore to be separated from the value-carrying matte.

The art of copper smelting lies in so proportioning the charge that neither iron nor silica nor sulphur be in excess or deficiency, while watch is kept on certain other substances, such as alumina, which may produce special complications if present in too large quantity. Further, the addition of lime to the iron and silica renders the slag lighter and more suitable.

The ore on the surface at the Yelta Mine allows the manager to make up the following charge :—

Copper	4·9 %	Lime	0·1 %
Silica	35·7 %	Sulphur	8·2 %
Alumina	4·8 %	Undetermined	5·1 %
Iron oxide	41·2 %		

He proposed to add 10 per cent. of limestone, which is equivalent to 5·5 per cent. of lime.

If the above be regarded as pounds avoirdupois I find that a 30 per cent. matte, with losses of volatilisation, &c., will account for 4·4lbs. of the copper, all the sulphur, and about 7lbs. of iron oxide. This leaves—

Silica	35·7lbs.	Lime	5·5lbs.
Alumina	4·8 "	Undetermined	5·0 "
Iron oxide	34·2 "		

Which will yield a slag with 42 per cent. silica and 40 per cent. of iron oxide. This is a good working slag, which can deal with the proportion of alumina present and separates readily from the matte. The past practical results confirm this conclusion.

Mr. Leigh Hancock, in an able paper contributed to the Australian Institute of Mining Engineers in 1905, gives the result of his work as follows :—Ore smelted—55·60 tons per day ; matte—assaying 28·33 per cent, with 90 per cent. recovery of copper ; slag—42 per cent. silica, 42 per cent. iron oxide, 8 per cent.

lime, with 4 per cent. to 5 per cent. copper. The last returns from the smelting under Mr. Guildford show very similar results, though by increasing the blast and coke he had raised the grade of the matte, while his slag assay averaged under 0·3 per cent.

The present ore is similar to that treated in the past. Some reserves of ore, which have an excess of iron, are available to correct any occasional variation in the quality of the ore from the mine, and the smelting of the ore should be practicable at a cost, but slightly in excess, of the 10s. 5d. recorded by Mr. Hancock in 1905.

With 6,513 tons of ore available, and no obstacle apparent to prevent their being converted into marketable matter, the question arises, what the cost of this conversion will be? To take the smelting costs first, based on a charge of 50 tons per day. Twenty men, including the superintendent, are required on the furnace, making labor charge of 162s. per day.

Coke is estimated at 11 per cent., but the past records give 12·3 per cent. and 13·4 per cent., so that 12·5 per cent. will be the safer estimate. This costs 30s. at the mine, or 187s. per day.

Limestone—Five tons per day, at 8s. 2d. at mine, 41s.

The cost of power is difficult to arrive at. It may be based on 50 horsepower, at a cost of 1d. per horsepower an hour, 100s. per day.

Repairs, assaying, management are also difficult to arrive at, but should be approximately 60s. per day under normal conditions.

Three horses are required to deal with the slag, at a cost of about 17s.

This makes a total of 570s., as follows :—

	Per Day.		Per Ton.
	s.		*s.*
Labor	162	..	3·24
Coke	187	..	3·74
Limestone	41	..	0·82
Power	100	..	2·00
Horses	17	..	0·34
Sundries	63	..	1·26
	570		11·40

This should be a fairly safe approximation. The mining figures are harder to estimate. The actual costs of stoping can be arrived at within certain margins, but, apart from the development work, it is difficult to figure on the standing charges in a mine such as this, where, for various reasons, they are bound to be high. Mr. Hancock's figures for 1905 give "Stoping costs 6s., and development 5s. 6d.," but it is not clear whether these figures, added together and multiplied by the tonnage smelted, would give the total costs of the mine. If so, then the profits should have been higher than they appear to have been.

Most of the stoping is by hand, and the manager advises that when the extra cost of power, &c., involved by machine work is taken into account there is not much difference in the cost. The price for stoping at the mine averages about £5 15s. for every 6ft. advance, 6ft. high, the miner being required to take out the lode to 6ft. wide before he receives any extra payment for width of lode. If the whole 6ft. were payable, since 12 cub. ft. of solid lode go to the ton, this would mean a cost of 6s. 4d. per ton. It is necessary in most cases to take out a width approximating the 6ft., but the manager estimates that 40 per cent. of the rock broken is picked out below. This brings the cost for stoping, timbering, and filling the stopes to 10s. 6d. Further, about two-thirds of the ore has one-third picked out at the surface, and returned to the mine as filling. This raises the cost to 13s. 6d. On to this must be placed the costs for timber, hauling, power, upkeep of shaft and pumps, and all the sundry expenses which go to the working of a mine.

Further, must be added the cost of development work, if such is in progress. These figures are hard to estimate, and are easily understated. It may help to figure out the probable total mine costs, when the output is 50 tons per day, from the basis of the present costs.

The manager estimates that with the water out of the shaft, which will set free a certain number of men, he will require only six more miners to bring up his output to the 50 tons. Also 16 more hands will be needed on the furnaces. His present staff consists of 124 men, costing £726 per fortnight. The following is an estimate of the expenditure per fortnight when the smelter is running :—

Fortnightly Costs.

	£
Present wages sheet—124 men	726
Add 6 miners, 16 furnace hands — 22 at £6	132
Add coal, 100 tons at 21s. 2d.	211
Coke, 87·5 tons at 30s.	131
Timber, at £3 per day	42
Explosives, one case per day	30
Oils	5
Candles	5
Management and sundries	32
	£1,314

This makes a total cost of £1,314 for 700 tons smelted, or 37s. 6d. per ton. Deduct smelting estimate of 11s. 5d., and this leaves 26s. 1d. Deduct cost of actual mining and 12s. 7d. remains for the various standing charges and other costs, without any material amount of development work. This appears high, and with things running smoothly some reduction could probably be made, but, beyond some small masonry work and the electric light wiring, no abnormal work appeared to be in operation to account for the above definite expenditure. It is hard to see how the total estimate of costs per ton can be taken at less than 35s.

Value of Ore.

The ore at present ranges close to 5 per cent. The value of a copper ore is frequently taken too hastily from the price per unit. With electrolytic copper at £70, a unit of copper is worth 14s., so that the contents value of a 5 per cent. copper ore appears to be at 70s. per ton. As a matter of fact in smelting to a 30 per cent. matte, as is proposed here, after allowing for the usual loss of 10 per cent., of the copper contents and the deduction due to refining charges, the contents value of 5 per cent. ore is very close to 49s. per ton. Similarly 4 per cent. is worth 39s., and 3 per cent. ore 29s. per ton. A table is attached showing the contents values of the ores according to the current price of the metal.

Taking the present price of £70 and 5 per cent. ore and costs at 35s., there should be a profit of 14s. per ton of ore mined and smelted ; of 37s. per ton on ore already at the surface, and approximately 24s. on the ore stored underground, this depending on how much will be picked out of it. Tabulated this is as follows :—

Surface	1,125	tons at	37s. =	£2,081
"	360	"	24s. =	432
"	5,028	"	14s. =	3,519
	6,513			£6,032

Coke to the amount of 500 tons has already been purchased ; limestone can be promptly secured, the plant is all in readiness. I should recommend that the smelting be started as soon as possible, and the ore available at the surface and

under ground converted into money. I regard it as certain that a profit can be made from this ore at present prices, and the actual working will show with greater certainty than the closest examination the quality and quantity of the ore that exists.

Economic Prospects.

If the ore supplies are limited to the above 6,513 tons, then in about four months' time this will be exhausted. What prospects are there of materially increasing the tonnage in the meantime ? It is even more difficult to arrive at definite figures in this case than in the case of the figures of costs above, more especially as the limits of profitable ore will depend on the price of copper as well as on other factors. All that can be done is to put forward the information that is available, and show what deduction can be made from it.

As far as the ground above the 210ft. level goes, there appears little likelihood of payable ore being discovered so close to the surface. At the No. 4 (270ft.) level, the level has been pushed out to the S. above the S. shoot, and the face shows ore worth about 2 per cent. The level was sampled from the face back to the old stopes, and gave average value of only 2·15 per cent., with average width of something over 3ft. 3in. As a whole the ore does not appear to be payable at this level, but some parts may be found to be profitable.

At the No. 6 (390ft.) level the S. drive has been extended 200ft. to follow up the lode channel in this direction. The result has not been promising. The lode has passed out, and two short crosscuts E. and W. have failed to pick it up. No sign of it shows in the face of the drive.

The ore occurrences have been dealt with down to the No. 10 (720ft.) level, to which the good ore extends. At the next, or No. 11 (840ft.) level, the shoot of ore shows in the back of the drive, and was sampled for 140ft. It yielded under 2·3 per cent. with a width of 2ft. 9in. At this level the lode is not payable.

At the No. 12 (960ft.) level the lode looks very poor, hard red felsite rock forming the gangue. The lode shows in the face of the drive, but is poor. The most promising part is just N. of the rise up to the level above. This portion, though, is very limited. The question arises whether the ore shoot lies further S. The plans of the old workings were not all brought up to date, and the present management could not correct them till the workings were unwatered. Hence in the section plan, published with the report of the Government Geologists the No. 11 (840ft.) level appeared not to have been pushed far enough S. to give decisive results. Really this level has advanced well beyond the level above, which itself has extended beyond the payable ore.

The theory has been put forward that the S. ore shoot has " pitched " S., and is still beyond the lower levels. The axis of this shoot, however, from the No. 6 (390ft.) to the No. 10 (720ft.) levels is nearly vertical, and the presence of the ore, though of low grade at the 840ft. and 960ft. levels, is unfavorable to this. The conclusion is forced upon one that shortly below the No. 10 (720ft) level the S. ore shoot has fallen in value and is not payable as a whole.

With the 1,080ft. and 1,200ft. levels it is impossible to deal definitely, since they were not accessible. At the 1,080ft. about half the ground on the main shoot S. of the shaft has not been stoped out, and the drive did not extend far enough to prove the S. shoot. Mr. Leigh Hancock's estimates of the value of the ore that the drive passed through were—

13–35ft.	4ft. wide	3½ %	90–120ft. 4ft. wide ..... 3 %
35–66ft.	"	2½ %	120–144 " ..... 4 %
66–90ft.	"	2 %	

An average of 3 per cent.

At the 1,200ft. level no development has yet been done.

The problem of continuity of the work, apart from any new discoveries which are always possible, depends on the grade of ore still left in the main shoot S. of

the shaft at the 1,080ft. level, which, if the plans are correct, should amount to 2,000 tons, and the grade of ore to be disclosed by drives on the lode from the 1,200ft. level. If the ore here can be profitably worked, then the question of deepening the shaft can be considered. In this matter of development, as in the matter of immediate ore treatment, the practical work of the next two months will be the chief guide. The mine cannot be a cheap one to work ; the shaft is small and not true, causing much extra friction, which means much loss of power and wear and tear. The shoots of ore are short, and the shaft is already down to 1,200ft. The grade of ore shows signs of gradually falling off with depth. Mr. Hancock gives his average copper contents of the ore for 1904 as 5½ per cent ; figures for 1905 give 4·9 per cent. Mr. Guildford's figures were from 3½ per cent. to 3¾ per cent. The main ore shoot from the 960ft. level down has branched, and the shaft itself is no longer in ore. At the lower depths the levels are hot and the ventilation is not too good. It will be easy to dissipate in the attempt to develop and deal with the ore at and below the 1,200ft. all the profits which accrue from the ore already developed at the higher levels. I strongly recommend bulk samples from the stopes above the 1,080ft. as soon as they are available, while if the 1,200ft. drives are put out, all ores from the drives should be paddocked separately and carefully valued. With copper at £70 unless the ore averages over 4 per cent., I do not consider it will be payable ; while it will require values considerably over this to justify the sinking of the shaft for another 120ft.

The small output is the real drawback to the property, and this is limited by the quantity that can be developed and procured from the mine, and not by the capacity of the smelter, which could easily be doubled. To limit the output of a deep mine to 50 tons per day is a heavy handicap. It applies not only to the machinery, but to the human integral as well. In effect it means that from the expensive department of supervision down to the humble position of braceman, work is being paid for at only a portion of its capacity. The results show not in the cost of this or that single operation, but in the grand total of expenditure which must go on for the small tonnage that is dealt with.

Purchase of Ores.

With regard to the possibility of purchasing ores from other sources, there is but little prospect of this. Nearly all copper ores that are offered for sale in Australia are either in the form of concentrates, which are not suited to the plain blast furnace work or hold an excess of silica. The Yelta ore, from the very fact of it being self-fluxing, is not suited for the admixture of other ores unless the happy occasion arose when both basic and silicious ores could be procured. The purchase of silicious ore in any quantity would entail also the purchase of barren flux, and the result would be unprofitable.

Sale of Property.

With regard to the disposal by sale of the property in view of the limited ore reserves this hardly appears feasible.

Prospecting.

This report so far has dealt with only the main lode at the Yelta Mine. The other workings on the property, with the exception of the prospecting shaft, were full of water, and their general features have been described in the report of the Government Geologists. At the prospecting shaft, situated about 850ft. S.W. of the main shaft, a lode has been disclosed and driven on N.E. at the 200ft., level. This lode does not correspond with the main lode, but may possibly be a lode which was cut by the long W. crosscut put out from the 210ft. drive in the mine. Unfortunately, the values are poor in both places, but the lode is well-defined, and since the lodes in this district have their best value at a greater depth than 200ft., this

deserves testing at 500ft. The diamond drill is certainly the best mode of doing this, to be followed by a crosscut from a lower level in the mine if good values ensued.

The whole property, both from its proximity to the Moonta lodes and from the good ore already mined from the Yelta and Paramatta Mines and various smaller workings, is deserving of careful examination, and diamond drilling inclined to cross the strata offers itself as the quickest and cheapest method of locating the values at depth. The drill is now at work to the east of the mine testing a surface lode at depth.

Final.

I may say that during the course of my inspection I saw no reason to consider that full value was not being obtained for the money expended. The contract prices throughout were reasonable That the costs appear high, and will, I believe, remain so, is due to the special conditions of the work, and not to the manager or able staff he has gathered round him.

Summary.

The property situated near Moonta in South Australia carries a copper-bearing lode in felspathic country rock which has been explored to a depth of 1,200ft. The main ore shoot has been worked out almost completely to 960ft. and partly to 1,080ft., and is untouched and unproven from No. 13 (1,080ft.) to No. 14 (1,200ft.) levels. A southern branch of the main shoot has not been depleted, and with some portions overlooked in the main shoot should provide some 6,000 tons of 5 per cent. ore. This can be mined and smelted at a cost of 35s. per ton, leaving a profit of about £6,000.

The prospects of finding further ore in the S. shoot are not good; the shoot becomes poorer below the 720ft. level and appears to cease to the S. There are prospects of securing more supplies from the main shoot between the No. 14 (1,200ft.) and No. 12 (960ft.) levels at present inaccessible, but there are indications that the ore here is not so extensive or rich as at the higher levels. Working costs at these depths will be higher. The result from the ore at these levels should be carefully watched and work abandoned promptly if not payable. If it prove sufficiently profitable, shaft-sinking should be resumed and pushed on as rapidly as possible. Meantime the other parts of the property are deserving of careful prospecting with the diamond drill to explore for other lodes, either on the line of the Moonta lodes or elsewhere.

WANDILTA MINE.

Situation.

This mine is situated about half mile to the E. of Kadina township, 117½ miles from Adelaide by rail, and six miles from the Port of Wallaroo on the Spencer Gulf.

Geology.

The geology of the district has not been worked out in detail, and the surface throughout is so concealed by the characteristic travertine of this part of the State that it is difficult to interpret the relations of the rocks that are met with.

It seems clear though that for a considerable area, embracing Moonta, 10½ miles to the S., and Wallaroo, 33 miles to the W., the underlying rock is of igneous origin; at Moonta the acidic type prevails and massive felsites are found. At Kadina the rock approaches more to diorite, and hornblende is very plentiful, the whole series probably belonging to the schists, classed by Mr. Brown, late Government Geologist, as part of the Archean systems of South Australia.

The character of the ore deposits is of very great interest, but the problems they submit cannot be determined from one small property. It would seem that there are two distinct classes of lode, the first being the true fissure lode, which is represented by the Wandilta lode, and is supposed to have been cut by bore 5 at 1,159ft. and bore 1 at 461ft. At these depths only iron pyrites was met with, the succession in depth of this mineral to either copper or galena ores being unfortunately none too rare. The inclination of this lode is at an angle of about 8° from to the vertical.

At the new prospecting shaft the dip of the country shows almost vertical in the end of the E. crosscut, both at the 180ft. and 285ft. levels. The lode at the bottom level, however, dips at 31° to the W. It is evident that an irregularity of some nature has occurred in the dip here. Now there is a class of lode typically represented by the saddle reefs of Bendigo occurring in the foldings of the strata here. A similar class occurs at Cloncurry, but there the lodes are found not in sedimentary strata but in crush zones caused by the folding or igneous rocks. The igneous rock—a hornblende diorite—is within a small area converted into schist, and in the folds of this schist lens like lodes occur of limited and tapering extent, both vertical and horizontal. At the Wandilta, I believe a local crush zone has developed, causing lines of weakness at an angle inclined to the general dip. The solutions carrying the calcite and hornblende with the copper values passed into these, filling any fissures formed and replacing some of the country rock as well. The lodes here would be better described as lodes of folding rather than as lodes of fracture or fissure lodes. While they may be of considerable width at their centres they do not offer the same promise of lateral or vertical extent as the more regular lodes of the true fissure type.

Surface Plant.

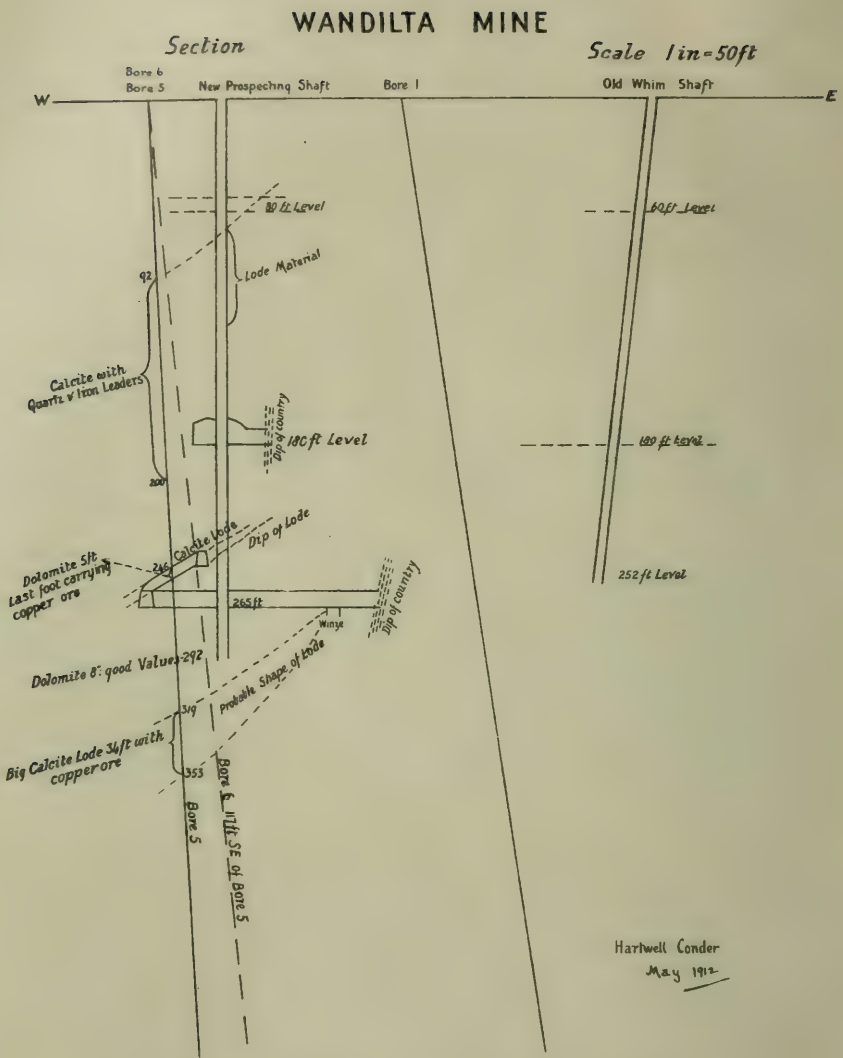
The mine is well-equipped in every way with good supplies of timber and other stores. The surface plant has been well-erected, and is maintained in an orderly and efficient manner, which is very creditable to the manager. It includes a 60-horsepower pumping engine, with 24in. cylinder bushed down to 15in. at present; a 12in. Cornish pump, with 8ft. stroke; a winding engine, with 4ft. 3in. drums and two boilers of 25 and 30 horsepower each. The poppet legs are strongly erected, 50ft. high with brace 16ft. from the ground level. There are the usual office buildings, and the whole composes a very efficient plant equal to dealing with the mine to a considerable depth.

Water.

The water problem here presents a peculiar aspect. The inflow at first amounted to 15,000galls. per hour, and has now dropped back to 9,000galls. It is pumped to an open space about a quarter of a mile distant, where it soaks away into the ground. I am strongly of the opinion that much of it finds its path back to the mine, incidentally maintaining the level of the water in the old workings on its way. The difficulty is that the mine is situated in a shallow depression of the country which would be a lake if the climate were not so dry. To deliver the water clear of this basin, so that it would flow away to any considerable distance, would entail a heavy outlay, so heavy that it would be cheaper to pay the extra cost involved by the return water, while the next 100ft. was being sunk, rather than inaugurate any drainage scheme. In the event, however, of permanent work being established on the mine, steps should be taken to convey the water away clear of any possibility of its returning to the soakage zone.

Mine Workings.

In the past the efforts of the miners were centred on the lode known as the Wandilta, which was opened up by three principal shafts known as the Whip, the Whim, and the Wandilta. The line of lode bearing N. 40° W. was worked from



A. VAUGHAN, GOVERNMENT PHOTOLITHOGRAPHER, ADELAIDE.

these shafts for a distance of 720ft., and the lode was traced further still by other workings. A considerable quantity of high-grade oxidised ore was removed from these workings, and the main shaft was carried down 252ft. on an inclination of about 8° from the vertical, the dip being to the W. These workings were ultimately abandoned and the property was acquired by the Government.

From the experience of former work it was known that much water would be encountered at depth, and arrangements were made to prove the downward extension of the lode by diamond drill bores before other steps were taken.

Bores.

Bores 1 and 2 were put down at the points marked on the plan. No. 1 bore, at 461ft., cut a seam of iron pyrites 1ft. wide, corresponding with the probable position of the lode, but nothing of economic value was disclosed. Bores 2 and 3 were put down further north without profitable result. The drill was then moved back about 240ft. from the line of the lode and bore 5 was started, inclined towards the lode at an angle of 3° from the vertical with the object of cutting it at a considerable depth. This bore passed through a seam of iron pyrites at 1,159ft. which was regarded as the Wandilta lode, and was of no appreciable value. Previous to that, however, at 246ft. it had entered a calcite seam 5ft. wide, carrying fair copper values. Below this again, at 319ft., it entered a large body of calcite extending for 34ft. Assays from the core here gave for the whole mass a value of 1·29 per cent. copper with values of 3·5 per cent. for one width of 3ft. In view of the ore values disclosed in this large mass of calcite, it was decided to sink a shaft to further explore it. The formation is quite distinct from the old Wandilta lode.

New Prospecting Shaft.

The shaft known as the New Prospecting Shaft was carried down to 60ft., and at this level crosscuts were put out E. and W., and a drive was carried on a lode formation encountered. In all, 250ft. of crosscutting and driving were done, but the results were not promising. It was decided to sink the shaft deeper. Water now gave a great deal of trouble, and it was with difficulty and heavy expense that the shaft was finally pushed down and levels opened up at 180ft. and 265ft. At the 180ft. level only 25ft. of driving was done and nothing of promise was revealed.

Small Calcite Lode.

At 235ft. in the shaft the calcite lode, corresponding to the 5ft. lode cut at 241ft. in the No. 5 bore, was encountered. At this point the lode carried high values, and in consequence the shaft was not sunk to get below the large calcite lode proved in the bore, but a level was opened up at 265ft. to explore the smaller lode. Crosscuts were put out E. and W. The lode was met with at 33ft. in the crosscut, and drives were carried along it in northerly and southerly directions. At this level the quality of the lode was not so high as in the shaft, and a rise was put up on the lode at an angle of 31° to reach the good ore there exposed. At the top of the rise, 12ft. vertically above the 265ft. level, an intermediate level was driven S. to trace the extent of the rich ore. This level also proved disappointing, and, at present, a rise is being pushed up from it in the lode to discover if good ore exists higher up.

The intermediate level was sampled. One sample near the shaft gave 4 per cent., and another 3·6 per cent., but there was no sign whatever of ore in the face, and the other samples were poor, so that the average value of the ore at this level comes out at 2 per cent. The ore would not bulk as high as this.

From the bottom level only two samples were taken, one at the crosscut gave 2·4 per cent., and one from the N. drive 0·8 per cent. The level was very carefully inspected, and it was clear that the lode was not nearly payable. Rich patches of chalcopyrite occur in the calcite, but they are so scattered that the value of the whole lode would be too poor to be worked profitably.

As far as this lode is concerned, the work done on it has resulted, so far, in proving that it is not payable ; and the prospects of any alteration in its character are so remote, that I advise the cessation of all further expenditure upon it.

Large Calcite Lode.

The question then arises as to the large body of ore 34ft. wide encountered in the bore hole which was the original object of the shaft. It seems a pity that the work should ever have been deflected to the smaller body. The large one was clearly of chief importance, and if that had been opened up the other also could have been readily tested by a vertical rise.

The point that now arises is whether the work be entirely abandoned, or the extra cost incurred of sinking the shaft another 100ft. and proving decisively the value of this lode.

An estimate was obtained from the manager of the cost of sinking another 100ft. to the lode. The details of this are attached, and the total amount comes to £3,000, to which must be added the cost of exploring the lode itself, possibly £1,000 more. These estimates appear high, but the manager has had a good opportunity of ascertaining the cost of work on this proposition.

If the lode displayed the characteristics of a true fissure lode, then this expenditure might possibly be warranted. The values shown by the bore are poor, the average of the whole being 1·29 per cent., and only one band 3ft. wide averages 3·5 per cent., but the ore body is large and has possibilities. If, however, its dip at all resembled that of the small calcite lode 27ft. above it, then it should have been cut by the W. crosscut at the 265ft. level. Further, if it continued S., No. 6 bore should have pierced it about 117ft. away from No. 5. At neither place is it seen, and it appears most probable that the bore has penetrated a lens like calcite formation, similar to the smaller one above it, with patches of very good ore, but *en masse* not payable. I do not consider there is sufficient promise here to warrant the heavy outlay that further exploration would entail.

The trouble is that if the work is abandoned without proving definitely the nature of this large ore body, the sum already expended will have been to some extent useless. Should it seem advisable to sink the extra 100ft. and exploit the lode, there is no doubt that there will be a certain satisfaction in having arrived at a definite conclusion, while there is always the possibility that payable ore may be found even when the general conditions appear unfavorable. In brief, I do not *think* payable ore will be found ; but there is the possibility, and it is for those who provide the funds to decide in such a case whether a further expenditure is warranted in order to settle conclusively a point which the expenditure of large sums to date has still left uncertain.

HARTWELL CONDER,
May, 19 2. M.A. (Camb.), (A.R.S.M.) London.

PARAMATTA AND YELTA COPPER MINES.

Report by Mr. Frank Richards, Manager.

I beg to submit the following report of operations at these mines for the six months ended June 30th, 1912 :—

Unwatering of the main workings to a depth of 1,080ft. was completed towards the close of the half-year, and the Cornish pumps are now drawing water from that depth. The shaft, timbers, and skipways have been strengthened in many places, so that now the shaft and appliances are in fair condition throughout.

Development work has been carried out in various parts of the mine and extensive blocks of ore ground prepared for immediate production.

Stoping operations were commenced early in the year, and 2,244 tons of ore of average assay value 5 per cent. of copper were sent to the surface. In addition to the quantity raised, 1,032 tons of similar grade ore are broken and stored in the mines ready for raising when smelting is undertaken.

Prospecting of other lodes on the Yelta lease has had considerable attention, but so far without discovery of note.

Particulars of development and prospecting work completed during the term under review are as follows :—

Development—	Ft.	In.
Driving	286	7
Winze-sinking	38	0
Rising	152	0
Crosscutting	4	0
Total	481	7

Prospecting—	Ft.	In.
Shaft-sinking	54	0
Winze-sinking	8	0
Driving	144	6
Crosscutting	274	6
Rising	5	6
Total	486	6

The smelting and other plants have been overhauled, and are now ready for continuous service. Suitable electric lighting machinery has been added to the plant, as well as a complete winding plant at No. 1 prospecting shaft.

With the present price of copper, there is every prospect of satisfactory returns when smelting is commenced.

WANDILTA MINE.

Report by Mr. A. W. Matthews.

Mining operations carried on at the Wandilta Mine, Kadina, for the half-year ended June 30th, 1912.

All the work has been confined to proving the lode cut in the shaft at 235ft., and also opened up in the crosscut at the 273ft. level.

Particulars of development work :

North drive, off crosscut, 273ft. level.—Driven on hanging wall of lode a total distance of 45ft. After driving 6ft. the shoot of good ore passed through in the crosscut gave place to low-grade lode, carrying patches and veins of rich ore, but not payable if taken in bulk.

A rise was put up off this drive 32ft., and connected with the vugh met when the shaft passed through the lode. Drives N. and S. were driven off this rise. N. drive driven 16ft. ; first 3ft. showing good ore, balance low grade. S. drive driven 68ft. ; mostly in low-grade material. At about 50ft. in this drive some good ore was met, and a rise put up proved same to only continue above the level a few feet. This rise was continued for 20ft., the face being poor.

South drive—273ft. level driven 48ft.; first 10ft. showing good ore on the foot-wall. From this point to face the lode was low grade. A crosscut was driven E. off this drive 14ft., proving lode at this point, 12ft. from wall to wall, values in crosscut low.

East crosscut, 273ft. level, continued from 40ft. to 79ft. At about 50ft. from shaft a calcite leader, 2ft. thick, was met, which carried good ore mixed with mundic. A winze was sunk on this 7ft., when the ore gave out.

West crosscut, 180ft. level, driven a total distance of 37ft., passing through several leaders of calcite, which carried fair ore.

East crosscut, 180ft. level, driven a total distance of 41ft. in country. Cut a flow of water in this crosscut, which is gradually draining the old workings.

Owing to the main shaft on the pumping plant breaking, all development work was stopped on May 18th.

Total development.—Crosscutting, 130ft.; rising, 52ft.; driving, 177ft.; sinking, 7ft.

THE CHIASTOLITE OR "LUCK STONE."

A Popular Amulet or Charm Stone Found in South Australia.

The discovery of these interesting stones at Mount Howden, near Bimbowrie, in the N.E. by Mr. G. R. Howden, a well-known prospector, has been previously noted, *vide* Review No. 9, page 28.

They are picked up on the surface, having been eroded from the surrounding rocks, and are also seen *in situ* in the rocks ; and when cut in transverse sections they show two crosses, one white or tinted, the other black and shaped like a Maltese cross.

These sections when polished, either unmounted or mounted in various ways in gold or silver, make handsome and unique ornaments, and the religious or believers in luck may make use of them as amulets or mascottes. Mr. Howden has furnished the following interesting statement :—

In Europe they are supposed to be bringers of fortune and happiness, and they were in great request in ancient and mediæval times both as amulets and luck bringers, the wearers holding them in high reverence, at the same time believing themselves secure against misfortune of every kind. This belief has been held through many centuries, and to-day there are many people who have the utmost faith in their virtues.

They were originally discovered in Andalusia, in Spain. Andalusia is asserted by Biblical authorities to be undoubtedly the Tarshish of the Scriptures, and was the scene of the martyrdom of St. James. The local tradition is that wherever the Apostle's hands touched the rocks the stones were marked with a cross. Some of the gems were afterwards discovered near Santa Elena, and were cut and sold at fabulous prices to the pilgrims attending the shrine of St. James ; but they have long since been unprocurable there.

Among the many interesting stories associated with the luck stone, the following is related :—

Abu Said el Bey Bermejo, who had usurped the throne of Ismael III., of Granada, fled to Seville from the rightful heir, under the promise of safe conduct from Pedro the Cruel, the then King of Spain, who received, feasted, and then put his guest to death in order to seize his treasure. Amongst the treasure were three huge rubies. The largest and best, called by Pedro "The Balax of the Red King," was given by him to the Black Prince after the victory of Navarette, and is the identical magnificent gem that now adorns the Royal Crown of England, and was worn by King George at his recent coronation. Before presenting this ruby to the Black Prince, reports had reached Pedro's ears of a wonderful stone that had been discovered by a peasant named Miguel Perez. This stone was $1\frac{1}{4}$in. in diameter and composed entirely of two crosses, the main or larger cross being of a blood red color, the other cross (similar in shape to a Maltese cross) being black.

Pedro, being determined to possess this stone in order to present it with the ruby to the Black Prince, sent for the peasant, commanding him to bring the stone with him to the Alhambra Palace. The peasant duly appeared with the gem, and was shown to an inner apartment where Pedro was lying on a couch. As soon as the peasant entered the room, Pedro demanded of him that he should at once deliver up the stone. The peasant hesitating, Pedro sprang up from the couch and drew his dagger. The peasant becoming frightened, held out the stone towards him, but the instant that Pedro's eyes met the blood-red cross, he fell headlong on the floor in a fit, during which the peasant escaped with the gem.

Many years afterwards the same stone came into the possession of Phillip V., a monarch of ascetic character, and was continually worn by him until his death. At his decease the gem was set in the dress of a figure of St. James the Apostle

which adorned the altar of the Cathedral of St. Jago di Compostella ; but during the Peninsula War the French Marshal Soult sacked the sacred edifice and carried off this venerated gem, together with 10cwts. of sacred vessels. The stone that was carried off by the vandals of the French commander came into Napoleon's possession, and was by him presented to his brother-in-law, Murat, King of Naples, and is still in the possession of the De Bodt's, one of the first families of France. The Spanish have made many ineffectual efforts to recover it.

A few others are possessed by wealthy Spanish families, and it is said that the Spanish ladies who own them would sooner part with any jewel they possess than with their *Piedra preciosa afortunada*, or precious stone of fortune. Probably there are no other gem stones in existence that have so many legends attached to them, and the one here related appears to be authentic, and was mentioned by several of the leading English newspapers in connection with the ruby in the Royal Crown at the time of the coronation of our present King.

South Australia is the only State in the Commonwealth in which the luck stone has been found, either in quantity or fit for jewellery purposes, and the stones from Mount Howden are undeniably the finest found in any part of the world. Short illustrated monographs on them have been written by Professor David, appearing in the American *Journal of Science*, and by Professor Anderson, of the Australian Museum, Sydney, with the assistance of Professor David, of Sydney University, and recently an elaborate and detail monograph by Dr. Douglas Mawson, of the Adelaide University, has been published under the auspices of the Royal Society. This is profusely illustrated, showing the various patterns and colors of the stones when cut and polished.

Miers Mineralogy gives under the heading Chiastolite :—

" Large crystals found in the Argillaceous schist at Rohan, in Morbihan (Brittany). They were known as ' Macles ' in very early times, and the origin of the name is supposed to be the heraldic term ' Macula,' used for the heraldic lozenge. It is believed that this device may have been introduced into their armorial bearings by the family of the Vicomte de Rohan to represent the chiastolite of their neighborhood."

The Government Geologist (Mr. L. Keith Ward) has supplied the following memorandum :—

The metal aluminium enters into combination with silica to form three minerals which are identical in composition but different in regard to density and crystallographic structure. These minerals are andalusite, sillimanite, and cyanite.

Chiastolite is a special variety of andalusite, which contains inclusions symmetrically disposed in such a manner that a cross is shown by transverse sections of the crystal.

The mineral is formed by the alteration of rocks which were originally argillaceous sediments, *i.e.*, rocks consisting principally of kaolin (clay). When kaolin is subjected to great heat and pressure the water which it contains is driven off, and one of the silicates of aluminium mentioned above is formed. In cases where andalusite is in process of crystallization in these argillaceous rocks which are undergoing alteration, various impurities are in some instances included within the growing crystals, and the variety known as chiastolite results. Most commonly the included impurities are clayslate, or carbonaceous material. As the crystallization proceeds the foreign matter is more or less completely expelled, and that portion which remains is arranged in harmony with the lines of growth of the crystal.

Different crystals show different cruciform patterns in cross section, and in many cases different parts of the same crystal exhibit a similar variation.

PLATE II.

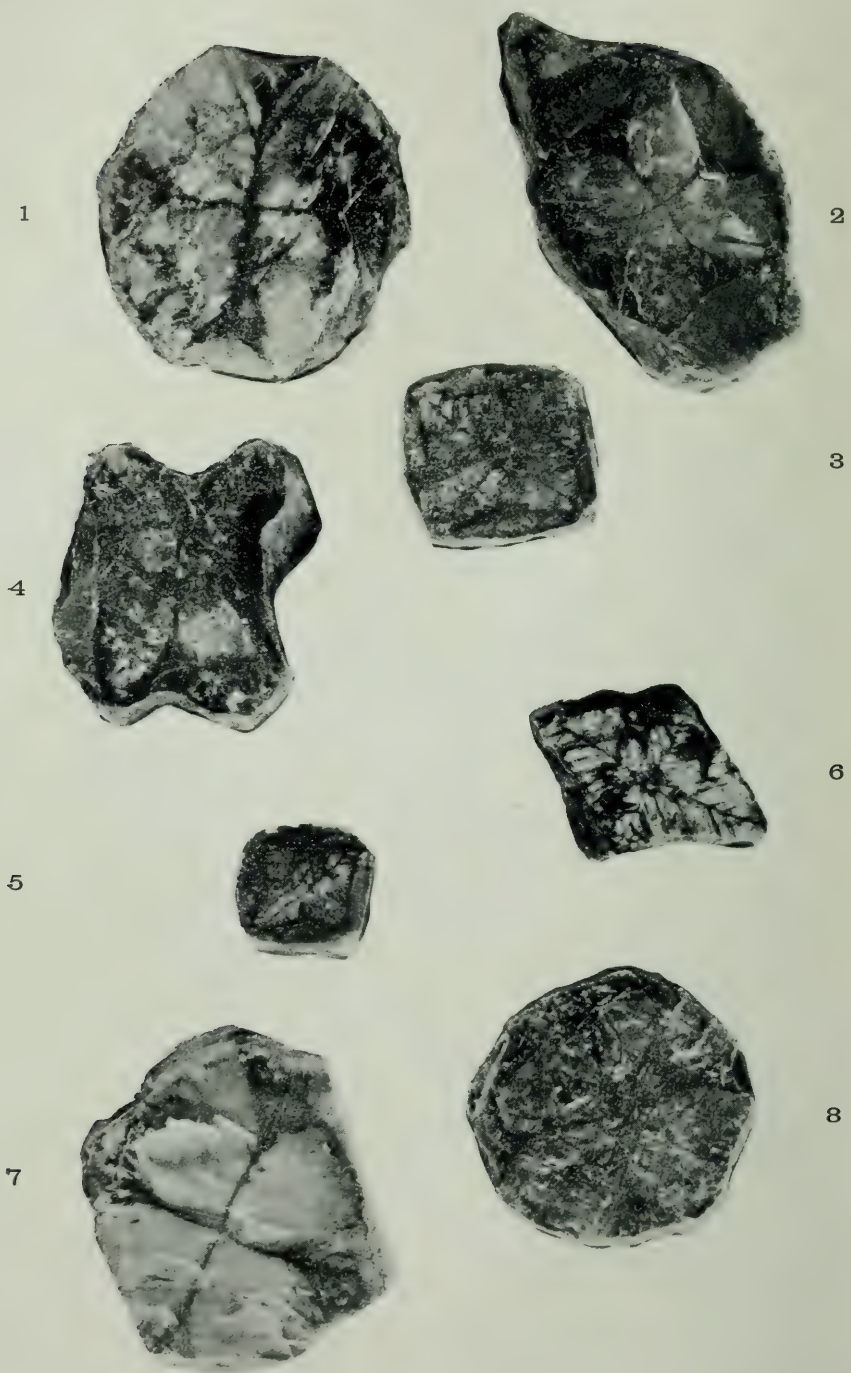


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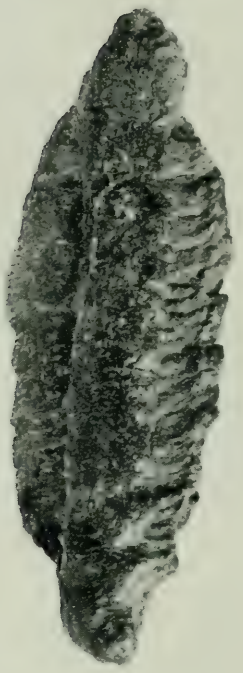
PLATE I.

1



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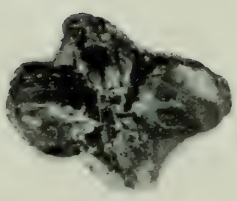

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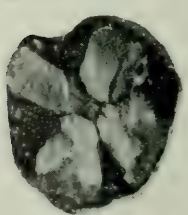

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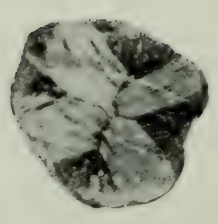

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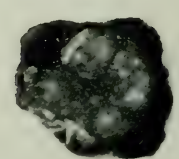

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The chiastolites from Mount Howden have an internal structure similar to those recorded from other parts of the world. The figure of a cross is in all cases well defined, though the unequal growth of different portions of a crystal may result in some distortion.

The central portion of the figure is, in some cases, occupied by a dark rhomb, while in other cases there are four dark rhombs in the angles of the cross. Less common are crystals which have a tesselated cross section through the development of the dark rhombs both in the centre and at the four corners.

The rock from which the Mount Howden crystals have been derived is an argillaceous schist in which they are embedded with their long axes parallel to the schistosity. On the disintegration of this rock, under the influence of weathering, the chiastolites, which are more resistant than the matrix in which they occur, are set free, and are readily collected. With the loose crystals strewn on the surface are found quartz, jasper, and a little aventurine.

The crystals have a rough exterior, which is in many cases covered with scales of mica. The dimensions are very variable ; but the length is usually from four or five times as great as the thickness. The largest crystals found are about 2in. in diameter.

The color of the crystalline material is rather variable. Grey is the predominant tint ; but yellow, pink, deep brownish-red, or white shades have been found.

The name of " howdenite " has been given to one special variety in which the rhombic section exhibits a dark centre, and a dark peripheral zone from which black rays extend towards the central part of the crystal.

PLATE I.

Fig. 1.—Complete crystal of chiastolite.

Figs. 2, 3, 4, 5.—Various sections of chiastolite crystals.

PLATE II.

Figs. 1, 2, 4, 7, 8.—Various sections of chiastolite crystals.

Figs. 3, 5, 6.—Sections of howdenite crystals.

REPORTS FORMING ADDENDA TO THE RECORD OF MINES

By the Inspector of Mines (Mr. Henry Jones).

Bullion Mine.—Situated about 4 miles from Willunga. The workings are situated on gradually rising ground, and consist of an open cut 20ft. long and 10ft. deep. A large lode formation is disclosed, striking E. and W., and dipping S. at an angle of 40°, composed chiefly of specular hematite and talcose schist, 8ft. wide. There are two veins of iron ore traversing the formation; the one on the hanging wall is 20in. wide, and the footwall vein 18in., with 4ft. 10in. of decomposed schist between them. The lode is well-defined and likely to continue down, but, as shown by the samples taken from various parts, it contains no mineral of commercial value other than iron.

Four samples taken from the bottom of the workings gave on assay at the School of Mines the following results:—

	Gold and Silver.
No. 1. Footwall vein	Nil
No. 2. From material in centre between veins	Nil
No. 3. Hanging wall vein 20in. wide	Nil
No. 4. Decomposed ferruginous material on footwall	Nil

The country for a considerable area in this locality is auriferous, and should be further prospected (15–1–12.)

The new workings are situated at the foot of a hill, about 30ft. below the open cut. A tunnel bearing N. and W. has been driven into the hill for a distance of 98ft., with a view of intersecting the iron formation operated on in the open cut, but so far the lode has not been met with; the country passed through is chiefly decomposed schist with small veins of hematite. Nine samples taken along the side of the tunnel show on assay that the material disclosed for the whole length of the drive contains no metallic mineral of commercial value. Sample taken of the ore obtained from the open cut gave 47·7 per cent. iron, but it contained no other mineral of commercial value.

A fair amount of good prospecting work has been done on the property, but the developments up to date are discouraging, no lode containing payable values having been discovered in any of the workings. (2–4–12.)

The Montacute Gold and Copper Mine (*vide* Record, pages 15, 84, 248, and Review No. 15, page 8).—Situated on the S. side of Sixth Creek about 10 miles from Adelaide.

A considerable amount of work appears to have been carried on at one time on this property. Several shafts have been sunk and a number of tunnels driven into the hills at various points, and in some of these workings large copper ore bearing material is disclosed, varying in width from 2ft. to 12ft., bearing N.E. and S.W.

The present main workings are situated at the foot of a hill 500ft. high. No. 1 tunnel extended into the hill a distance of 315ft has been cleaned and repaired. At a point 300ft. in the tunnel a large formation was intersected consisting of ferruginous slate, quartzite and quartz and iron veins carrying small patches of copper sulphide and iron pyrites.

Recently a winze was started in the formation and sunk vertically to a depth of 29ft., from which point the winze was carried down on the underlie in the footwall portion of the lode to a depth of 20ft., which appears to be water level. The formation disclosed in the winze as far as sunk on is of low grade, but at a point 25ft. down a small pocket of fairly good ore, which did not continue down, was obtained in sinking.

No. 2 tunnel, situated about 2 chains E. from No. 1, is in a total distance of 140ft., and at 100ft. a large irregular lode formation was intersected, consisting chiefly of quartzite with veins of quartz and iron, carrying small seams of copper ore, chiefly carbonates, with small patches of sulphides.

A winze has been started in the formation and sunk to a depth of 8ft. The ore in the bottom is similar to that in the tunnel, and appears likely to continue down.

Lean's Tunnel.—Situated 3 chains W. from No. 1 workings, has been extended in a W. direction for a distance of 68ft. This is in a direct line with the vertical shaft, sunk from the brow of the hill to a depth of 110ft. In this shaft two lodes were intersected and operated on, and a large quantity of high-grade ore was obtained from the workings.

The Lean Tunnel should, if extended a further distance of 70ft., meet with the lodes operated on in the shaft, then drives could be extended S. in the lodes; this would prove the value of the ore bodies and make available large blocks of lode material to stope out from the level of the tunnel to the top of the hill, and both the shaft and tunnel workings would be connected, which would give good ventilation to carry on operations in the two lodes. On the surface near the top of Lean's Shaft there are several small dumps of discarded lode material which appeared promising for carrying values in gold and copper. Three picked samples gave on assay—

	Copper.	Gold.	Silver.
No. 1.	12·5 %	1dwt.	15dwts.
No. 2.	6·3 %	3dwts.	1oz.
No. 3.	6·8 %	8dwts.	1oz. 18dwts.

Judging from the results obtained from the above samples, the ore body operated on in the shaft appears fairly promising and warrants being further developed, which could be done with a comparatively small amount of capital by extending Lean's Tunnel.

Samples taken from the formation intersected in No. 1 tunnel show that the ore body is of low grade, with small patches of ore in places—

Nos. 1 and 2. Side of tunnel for 12ft.	No value
No. 3. 29ft. down the winze	1·2 % copper
No. 4. Picked ore from winze	14·4 % "

The last sample (No. 4) was taken from a dump of 1 ton of ore stacked on the surface, obtained from a small pocket in sinking the winze.

Four samples taken from the large lode formation disclosed in No. 2 tunnel show that the formation at the point intersected is of low grade.

No. 1. For a section of 5ft.	2·3 % copper
No. 2. For section No. 2 of 5ft.	0·4 % "
No. 3. " 3 of 10ft.	2·2 % "
No. 4. " 4 of 10ft.	1·8 % "

This lode appears strong and likely to continue down. (12–3–12.)

The Young Bullfinch Gold Mine (also known as "Hynes' Reef," *vide* Record, page 270).—Section 6396, hundred Talunga, situated three miles from Blumberg.

A great number of old workings are seen at various points on the property, consisting of several shafts, open cuts, and at one point a tunnel has been extended into the hill for a distance of 850ft. As shown in the Record of Mines a large quantity of gold-bearing lode material was extracted from these workings and treated at the Government Cyanide Works, Mount Torrens. Some of the parcels being fairly rich, yielding from 1oz. to 2½ozs. of gold per ton.

The mine has been idle for a number of years, all the old workings are in a dilapidated state, and therefore could not be examined. Work was started recently on the property with a view of testing the ore bodies of a greater depth. The main workings are situated on the side of a hill, and consist of a vertical shaft, 10ft. by 4ft., securely timbered to a depth of 130ft.

At the bottom of the shaft a lode formation was intersected, consisting of ferruginous quartzite with quartz and iron veins and bands of soft kaolinised material. A drive from the bottom of the shaft in the formation has been extended S. 30° W. for a distance of 30ft., and from that point a crosscut has been made W. in the quartzite for a total distance of 18ft.. Opposite the latter it has been driven E. for a distance of 22ft. The country disclosed in this crosscut is quartzite for 10ft. and decomposed slate for the last 12ft.

Nine samples taken along the side of the crosscut for a length of 36ft. gave no values on assay. This proves that the gold-bearing material operated on in the shallow workings has not yet been intersected at this level, but, judging by what can be seen in the old workings and in the vicinity of the present shaft, it appears quite probable that by extending the crosscuts E. and W. there is a reasonable chance of intersecting some of the veins that carried gold at shallower level.

The main shaft has been equipped with a small winding and steam pumping plant, and everything in connection with the mine is in good order for carrying on exploration work. The country in this district is highly auriferous, and large quantities of alluvial gold have been obtained in the various creeks and gullies in the vicinity of the Young Bullfinch Mine. Judging from past surface developments the prospect of meeting with a payable ore body traversing the property is very encouraging. (14–3–12.)

Deloraine Gold Mine (*vide* Reviews Nos. 10, 13, 14, and 15).—No. 7 underlie shaft, situated S. from the main workings has been sunk to a depth of 67ft. from the surface, and at a depth of 27ft. has been connected with the tunnel workings at this level. A fair amount of work has been done in the lode, and large quantities of rich ore were extracted from the tunnel.

The shaft is now 40ft. down below the floor of the tunnel, and a start has been made to drive S. in the lode ; the drive is in a total distance of 15ft., the ore body is from 6in. to 12in. wide carrying rich gold. A parcel of 11 tons of ore extracted from these workings was recently treated and yielded 2ozs. 18dwts. 11grs. gold per ton.

At No. 3 shaft the work of erecting a new Cornish boiler, 18ft. x 6ft., and a 40-ft. stack has been completed. A large sinking pump has been landed at the mine, and as soon as that has been placed in the shaft and steam connections made, sinking will be resumed to test the lode at greater depth and open out the mine. (20–3–12.)

Kitticoola Gold Mine (*vide* Record, page 70, and Reviews Nos. 8, 9, 13, 14, and 15).—From the 120ft. level N. of the underlie shaft a rise in the formation has been started and put up 60ft. When this has been completed up to the surface it will prove the width and value of a large block of ground, and can also be utilised for conveying mullock down to fill in the stopes below the 120ft. level.

N. of No. 1 winze stoping is in progress above the 240ft. and 180ft. levels, the ore body disclosed in the various stopes is fairly defined making wider and stronger going N., and it appears quite likely that the lode will continue for a great distance in that direction.

There are large blocks of lode material at each level available for stoping out which consists chiefly of ferruginous quartz and iron seams carrying gold for a width of from 2ft. to 5ft.

The 10-head stamp mill on the mine is kept at work 16 hours per day treating from 50 tons to 60 tons per week.

The lode material disclosed in the working places at the various levels appears very promising, and the future prospects of the mine are very encouraging.—(20–3–12.)

The Ajax Gold Mine, near Waukaringa (*vide* Record, page 196, and Reviews Nos. 8, 11, and 14).—A large amount of development work is in progress on this property, both on surface and underground, with a view of working the mine on a more extensive scale as soon as sufficient water for the treatment plant has been obtained at Simon's Well.

The main underlie shaft has been equipped with winding steam winch and a new tramline put down the shaft from the surface to the 170ft. level. A start has also been made at that level to drive E. in the lode; the drive is in a total distance of 20ft.

The W. drive opposite the last has been extended and is now in a total distance of 172ft.. At a point 169ft. in, the drive has been connected with No. 2 underlie shaft; this makes available a fairly large block of ground for stoping, and the ventilation will be good throughout the workings. The erection of a cyanide plant is in progress and a 34-H.P. suction gas engine has been placed in position to work the battery and agitating vats. Everything in connection with the mine and plant appears in a good way for carrying on future operations. (23–3–12.)

The New Medora and Mount Grainger Gold Mine (*vide* Record, page 250, and Reviews Nos. 8, 9, 13, 14, and 15).—Since my last visit to the mine a fair amount of work has been done in the lode from Jones' underlie shaft.

At the 15ft. level a drive has been extended S.W. in the formation for a distance of 30ft., and at the S. end a winze has been sunk to a depth of 21ft.. The lode material disclosed in these workings consists chiefly of slate with small veins of quartz and iron carrying gold. A sample taken of the lode material gave, on assay, 2dwts. of gold per ton.

In the vertical shaft at the 120ft. level a crosscut has been extended W. 86ft.; a small leader, 4in. wide, was intersected and driven in for a short distance; a sample taken of the vein material gave no value.

The crosscut E. opposite the last has been extended 46ft.; the country passed through is chiefly slate.

A start has been made to erect a cyanide plant on the mine to treat the tailings, and most of the vats required for the work have been placed in position. (28–3–12.)

The Dustholes Gold Mine (*vide* Record, p. 214, and Reviews Nos. 8, 13, 14, and 15).—Principal work carried on recently on the property was the sinking on block No. 1484 of a new shaft, which is down 26ft. vertical and 10ft. on the underlie. The lode formation disclosed consists of ferruginous quartz and iron veins, 18in. wide, carrying gold.

At the 26ft. level a drive in the lode has been extended N., a total distance of 60ft., the vein of ore disclosed is chiefly quartz and iron 8in. to 12in. wide, containing patches of fair gold—a parcel of 8 tons of the ore extracted from the workings was treated at the Government Cyanide Works, Petersburg, yielding 1oz. 1dwt. gold to the ton.

A fair amount of prospecting work has been done for a considerable length along the line of lode both N. and S. from the present workings. At one point a reef 18in. wide is disclosed, containing bismuth and gold. Sample taken of the ore gave on assay 1oz. 14dwts. of gold and 11dwts. silver per ton. This vein is well worth testing to a greater depth. (10–4–12.)

The Mountain of Light Copper Mine (*vide* Record, p. 129, and Reviews Nos. 8, 10, and 13).—Situated about 2 miles S.E. from Leigh Creek. A large lode formation traverses the property, bearing E. and W., and dipping S. at an angle of 45°; the country rock inclosing the lode consists chiefly of clayslates with bands of sandstone.

A considerable amount of work to a shallow level has been done on the property at different times. Several shafts have been sunk, some vertical and others on the underlie of the lode, and have been carried down to water level, a depth of 60ft. where drives on the course of the formation have been extenedd both E. and W. connecting the various shafts. The ore body above the drives in several places has been stoped out up to the surface.

The formation disclosed in the various workings consists chiefly of clayslate and kaolin, 3ft. to 4ft. wide, containing nodules and seams of green and blue carbonates and bunches of grey ore and black oxide. Judging from the large amount of work done on the property, some thousands of tons of lode material have been extracted from the workings, which must have yielded a large quantity of high-grade ore. The lode formation is fairly defined in the old workings, but diverges in places from its usual course, owing, apparently, to contortion in the country rock. There are strong indications in the bottom levels that the lode will continue down to a depth.

The Government, with a view of thoroughly and expeditiously proving the ore body at greater depth, have approved of a series of diamond drill bore holes being put down on the property. Sites have been selected for the first three holes on a parallel line with the strata of the formation, and if the latter continues down at the angle showing in the old workings, the ore body should be intersected at from 360ft. to 400ft. from surface. (17–4–12.)

The Aclare Silver Lead Mine (*vide* Record, p. 162).—Situated on section 1296, in the hundreds of Kanmantoo and Strathalbyn, about 3 miles from Callington Railway Station.

A large mineralised lode formation traverses the property, and on top of a hill 200ft. above the creek the outcrop of the lode is prominent for a length of about 200ft., bearing N. 10° E., and with an eastern underlie of about 1 in 3. It consists chiefly of micaceous schist and quartz, varying in width from 5ft. to 10ft., containing silver lead, zinc, and a little gold.

Workings.—From the N.E. side of the hill, a few feet above the creek and on a level with the old treatment plant, an adit in country rock has been extended in a S.W. direction for a distance of 830ft., where the shoot of ore discovered on the surface was intersected; and from that point driving in the formation was continued for a distance of about 230ft. The lode formation disclosed along the drive is from 5ft. to 8ft. wide, and consists of micaceous schist with small veins of zinciferous galena containing from a trace to 2dwts. of gold per ton.

A considerable amount of work in the past has been done below the bottom of the drive by winze sinking, driving, and stoping out ore; but most of the old working places, at the time of my visit, were inaccessible and could not be examined.

Near the S. end of the drive a winze has been sunk to a depth of 60ft., and for about 20ft. or 30ft. S. from it stoping has been done up to the level and down on an angle to the S. for a depth of 30ft. below the bottom of the main winze.

The lode formation disclosed in the face of the workings is fairly defined and from 4ft. to 6ft. wide, with rich veins of sulphide ore 4in. to 8in. wide on both foot and hanging walls, and from 2ft. to 3ft. of low grade material between.

On the top of the hill about 200ft. above the level of the creek, two shafts, 120ft. apart, have been sunk, and are connected with the tunnel workings at the 30-fathom level. Driving and stoping have been done in the ore body from both shafts, and large quantities of high-grade ore were extracted from the various workings.

The main shoot of ore so far disclosed in the mine, which has been operated on from the surface to a depth of 45 fathoms, is from 120ft. to 130ft. long, and judging from what can be seen in the various workings, the formation is fairly defined, and the shoot of good ore has a S. dip and appears likely to continue down to a fair depth.

Future Working.—To further prove the ore body and open out the mine, the best plan would be to select a site for a new main shaft at a point S.E. from the old shafts on the hill, so as to intersect the lode formation at from 400ft. to 500ft. from surface. This would prove a large area of unexplored ground, and the mine could be opened out on a fairly large scale with every facility for hauling the material from the deep levels.

Tailings.—There are about 2,000 tons of tailings at surface near the site of the old plant. Two samples of the tailings were taken from various points and gave on assay—

No.	Gold.	Silver.	Lead.	Zinc.
1.	1dwt.	11ozs. 5dwts.	Trace	6.1 %
2.	1dwt.	7ozs. 5dwts.	Nil	2.6 %

Samples taken from the lode along the drive, 30-fathom level—

No.	Gold.	Silver.	Lead.	Zinc.
1.	Nil	Trace	Nil	1·1 %, width, 5ft.
2.	Nil	2ozs. 10dwts.	6·7 %	8· 9 % "
3.	Trace	2ozs. 4dwts.	8·5 %	12·3 % "
4.	2dwts.	2ozs. 16dwts.	Nil	4·4 % "
5.	Trace	1oz. 10dwts.	Nil	12·9 % "
6.	1dwt.	18ozs. 4dwts.	9·8 %	12·2 % "
7.	2dwts.	14ozs.14dwts.	8·1 %	14·8 % "

Samples from south face of working below tunnel level—

No.	Gold.	Silver.	Lead.	Zinc.
1.	3dwts.	47ozs.	16·4 %	28·1 %, veins, 4in. to 8in.
2.	Trace	Trace	Trace	Nil " "
3.	1dwt.	3ozs. 3dwts.	8·8 %	35·2 % " "

Samples taken from outcrop of lode near old shafts—

No.	Gold.	Silver.	Lead.	Zinc.
1.	1dwt.	26ozs. 15dwts.	5·8 %	Nil
2.	1dwt.	4ozs. 14dwts.	Nil	Nil

Buildings.—There are several substantial buildings on the property, all in fairly good order—Manager's house, 10 rooms, wood and iron building ; overseer's house, 6 rooms ; foreman's house, 4 rooms ; assay office, well built, stone ; stables and smithshop ; boiler and engine house ; one large roasting furnace with building ; one cement tank, 24ft. by 24ft. by 12ft. deep.

Water.—In the vicinity of the mine there are two creeks with running water from which ample supplies of good fresh water can be obtained for all requirements.

Fuel.—Wood for fuel is fairly plentiful in the district and could be delivered on the mine at reasonable prices.

In conclusion, I may state that the general prospects of the property are favorable, and the shoot of ore already operated on down to the present depth appears likely to continue down ; and, probably, when the mine has been more extensively opened out and drives extended on the course of the formation, other shoots of ore of equal value will be discovered. I see no reason to doubt the success of the mine if capital could be obtained to fully and properly develop the property and equip the mine with modern machinery. (7–5–12.)

The Hamley Copper Mine (*vide* Record, p. 61, and Reviews Nos. 9, 10, 13, and 14).—Mining is in progress at various levels N. and S. from No. 1 and No. 2 shafts, and the lode formation disclosed in the workings is from 6ft. to 10ft. wide, with a number of seams of sulphide ore through the matrix, varying in width from ½in. to 6in. or 8in. wide.

Forty-fathom Level.—The rise, started at a point 100ft. N. from No. 1 shaft, has been completed up to the surface. This will greatly facilitate the working of the N. portion of the mine. The stopes can now be filled with mullock, which is absolutely necessary in operating on large ore bodies of this kind, both for safety and economy of working. A start has been made to stope out the ore body, both N. and S., from the rise, and a large block has been taken out to a height of 18ft. above the back of the drives. The formation here is from 6ft. to 8ft. wide, with seams and bunches of sulphide ore through the matrix.

Fifty-fathom Level, N. of No. 1 Shaft.—A large block of ground has been stoped out over the back of this level, the drive has been strongly timbered and covered with laths, and the filling in of the stope with mullock is now in progress and will soon be completed.

Sixty-fathom Level, S. of No. 2 Shaft.—A rise has been put up from this level to the 50-fathom drive. This rise should be extended through to the surface, and thus prove a large block of unexplored ground which appears likely to contain good grade ore ; and the rise, when completed, could be made use of to convey mullock down to fill in the stopes at the various levels in the S. part of the mine.

Between the 60-fathom and 70-fathom levels a fair amount of stoping has recently been done in the formation, which shows a width of from 5ft. to 8ft., containing veins of high-grade ore. Timbering the ore passes and filling in the stope with mullock is now in progress. This work will take a fair amount of time, and on completion, stoping will be resumed.

Seventy-fathom Level, 80ft. N. of No. 1 Shaft.—Stoping N. over the back of the drive is in progress ; the lode formation disclosed in the face is from 5ft. to 6ft. wide, with veins of sulphide ore. The vein near the hanging wall is from 8in. to 12in. thick of high-grade yellow ore.

General.—The ore-bearing material disclosed in the working places at the various levels is well-defined, and from 6ft. to 15ft. wide, and appears likely to traverse the whole length of the property on the hanging wall of the old lode and should produce great quantities of copper ore.

The future prospects of the mine are encouraging, and if the mine is properly developed and worked on a more extensive scale, it would have a fair chance of becoming a payable mine. (14–5–12.)

The Wild Dog Copper Mine (*vide* Reviews 9, 10, and 13).—Situated 2 miles S.E. from Leigh Creek. In the old workings two lode formations are disclosed in which a fair amount of work has been done by open cuts and shallow sinking, and large quantities of high-grade carbonate ore obtained.

The ore-bearing material consists chiefly of ferruginous slates, containing green carbonate and small seams of grey ore ; the formations so far exposed in the shallow workings are fairly promising and worth testing at greater depth. (18–4–12.)

Mount Coffin Copper Mine (*vide* Record, page 87, and Reviews Nos. 9 and 13). —Situated about 8 miles E. from Leigh Creek Railway Station. The main working consists of an underlie shaft sunk on the lode formation, and a large amount of stoping and driving has been done in the lode at various levels. The drive E. is in a total distance of 110ft., and the W. drive 70ft.

Stoping is in progress over the drives at the 60ft. level, and large blocks of lode material have at various times been stoped out. The formation disclosed consists of slate, 2ft. to 3ft. wide, containing small veins of high-grade copper ore, chiefly copper glance and malachite. A sample taken from a small parcel of dressed ore gave 28·2 per cent. copper, and a sample taken from a large dump of seconds gave 8·2 per cent. copper. (18–4–12.)

The Black Eagle Copper Mine (*vide* Reviews Nos. 9, 10, 12, and 13).—Situated about 1 mile S. from the Ediacara Mine. Prospecting work is in progress on the W. lode, the formation disclosed in the various pits and open-cut workings consists chiefly of iron and quartz 3ft. to 5ft. wide, carrying small veins and bunches of green carbonate.

From Nos. 1 and 2 tunnel workings 22 tons of ore sent away recently gave a return of 9·6 per cent. copper. There are several tons of similar ore at surface. (19–4–12.)

The Beltana Rapid Ore Treatment Syndicate's Mine, situated 3 miles W. of Beltana, and previously known as the Copper Queen Mine (*vide* Reviews Nos. 9, 10, 14, and 15).

A new vertical shaft was recently started at a point a short distance S.E. from the old workings. The shaft is 6ft. by 4ft. 6in. in the clear and is sunk to a depth of 72ft., strong and securely timbered from surface to bottom with sawn timber, and equipped with substantial ladders down to the 60ft. level.

At a depth of 60ft. in the shaft water level a prospecting crosscut has been driven E. for a distance of 10ft. in soft decomposed slate containing nodules and thin seams of copper ore, chiefly malachite, also strains of vanadium.

The ore-bearing material traversing the property appears of considerable width, with no properly-defined foot or hanging wall showing; and, judging from indications on surface and in the workings, the largest portion of the lode, and probably the richest, appears to be to the E. of the main shaft, and to further prove the full width and value of the formation at the present level a crosscut should be started in an E. direction from the plat, opposite the W. one.

The water making in the shaft at present level is fully 2,000galls. in the 24 hours, which quantity is considered sufficient to enable both the crushing and precipitating plants being worked continuously.

The two new cement and concrete vats, 15ft. long, 13ft. wide, and 13in. deep each, and one vat 23ft. long by 10ft. wide and 16in. deep, have recently been constructed on the side of the hill convenient to the crusher, so that the pulp from the latter will run direct by gravitation into the vats for further treatment.

A start has been made to take out the foundations for three more vats. When these are constructed it will facilitate the working of the plant, and larger quantities of ore can then be treated.

Eight samples of the lower grade ore were taken from different parts of the property and assayed with a view of testing the percentage of vanadic acid (V_2O_5) the ore contained—

		Copper. %		Vanadic Acid (V_2O_5).
No. 1	Sample. Ore from 6 mile	3·3	..	Nil
" 2	" " "	11·8	..	0·3 %
" 3	" 4ft. hole	2·8	..	Present
" 4	" 2ft. hole	4·4	..	0·4 %
" 5	" 10ft. hole	0·8	..	0·6 %
" 6	" 1½ chains N.	6·3	..	Present
" 7	" 72ft. level	2·5	..	Present
" 8	" Iron vein	0·4	..	Present

None of the above samples show any radio-activity. (19–4–12.)

Boulder Block Copper Mine (*vide* Review No. 9).—Situated 2 miles N.E. from Mochatoona Springs.

In the main underlie shaft at the 50ft. level the S.E. drive on the course of the lode has been extended a total distance of 31ft. The formation disclosed is from 6ft. to 8ft. wide, and consists of ferruginous calcite and slate, with seams and bunches of copper pyrites and malachite.

Stoping out the ore over the back of the drive is in progress. The lode is 4ft. wide, showing nice pockets of good average ore.

Five samples of the lode material gave on assay the following results :—

		Copper.
No. 1	from dump of seconds	6·6 %
" 2	No. 2 dump of seconds	8·3 %
" 3 "	Dump of dressed ore	12·9 %
" 4 "	Stope 50ft. level	4·1 %
" 5 "	N.E. workings	4·3 %

(22–4–12.)

Walter's Copper Mine.—Situated about 5 miles S. from Beltana

A large lode formation traverses the property, bearing N. and S. dip W. A fair amount of work has been done in the ore body at various points for a length of 100ft. The workings consist of open cuts and one shaft sunk to a depth of 20ft. The ore-bearing material exposed in the old workings and surface dumps is of similar nature to that operated on at the 6-mile claim. and by its trend it appears to be the continuation N. of the same formation, composed mainly of clayslate, thickly impregnated with blue and green carbonates.

Judging from what can be seen in the present limited workings and along the surface, the property appears very promising, and is well worth being further developed and worked in a proper manner. Two samples of the ore taken from the dumps gave on assay—No. 1, 8·2 per cent. copper ; No. 2, 4·5 per cent. copper. (25–4–12.)

The Six Mile Copper Claim.—Situated about 1 mile E. from the railway line, and 6 miles S. of Beltana.

A large amount of prospecting work has been done at various points on the property by open cuts and shallow sinking to depths of from 4ft. to 15ft.

In the various workings ore-bearing material is exposed for a length of about 1½ chains ; it has the appearance of a flat lode, and consists chiefly of clayslate densely impregnated with green and blue carbonates and thin veins of grey ore in the joints.

The ore body traversing the property, so far as disclosed, is very promising, and appears likely to extend for a considerable distance both N. and S. from the present workings.

Two samples of picked ore from the various dumps of lode material on the surface gave on assay—No. 1, 11·1 per cent. copper ; No. 2, 7·1 per cent. copper. (28–4–12.)

The Asbestos Mine.—Situated in the hundred of Arkaba, 9 miles from Hawker. Inspected on June 4th and 5th. The holding consists of 2 square miles of country held under search licence.

The main workings are situated near the S. boundary of block No. 99/12, 1 mile N.E. from Red's Whim Well, and comprise one shaft and a number of open cuts.

On elevated ground 60ft. to 70ft. above the gully an underlie shaft has been sunk in asbestos formation to a depth of 53ft. All the way down the shaft the country is decomposed clayslates and sandstone, containing a great number of seams of asbestos. Some are running parallel with and others crossing the formation and varying in width from 1in. to 4in. wide. These veins occur irregularly through the matrix. In places several seams are fairly close together, and at other points they are found to be from 1ft. to 4ft. apart.

From the bottom of the shaft a drive has been extended in a S.E. direction for a distance of 40ft. Along it for the first 10ft. and for the 9ft. nearest the face a number of asbestos seams 1in. to 3in. wide are showing in both places, with about 21ft. of ferruginous slate between the two formations, which does not appear to contain any asbestos where driven through.

On the surface in the vicinity of the shaft a considerable amount of prospecting work has been done by open trenches 3ft. to 6ft. deep across the formation at right angles to its bearing, exposing veins and bunches of asbestos 1in. to 6in. thick in the matrix for a width of about 100ft., and for a length of about 150ft. to 200ft.

The asbestos-bearing material disclosed in the above workings appears to be bearing N.E. and S.W., and at points ½ mile and 2 miles respectively in a N.E. direction and almost in a diagonal line across the 2 square mile blocks.

The asbestos formations are visible in two of the water channels traversing the property.

In Saltwater Creek, ½ mile N.E. from the shaft, a number of asbestos seams are visible in the decomposed material on the side of the creek varying in thickness from 1in. to 3in., and for a width along the S. side for 50ft.

About 1½ miles further N.E. what appears to be the continuation of the same asbestos-bearing material is showing fairly prominently on the N. side of Woolshed Creek in veins and bunches 2in. to 6in. wide, and a fair quantity of asbestos has been washed out of the rocks and concentrated in places along the bed of the creek.

Judging from what can be seen at the various points on the property, and in the shaft workings, the asbestos-bearing material disclosed appears of considerable length and width, and is well worth being further developed and worked in a systematic manner.

The prospects of a great quantity of blue asbestos being available on the property are exceedingly favorable, and at different parts of the blocks large quantities of the asbestos-bearing material could be extracted by open-cut workings.

Fourteen samples taken from the formation and asbestos seams at different parts of the property were determined by the School of Mines. The asbestos contained is the mineral species (Crocidolite) or blue asbestos of fairly good quality, and when cleaned is worth from £10 to £15 per ton.

The future prospects of the property are very encouraging, and with a properly constructed plant to treat the crude material to liberate the adhering rock particles from the asbestos fibre to assure a good marketable product, the venture would have a reasonable chance to become a large and important industry in the State, and a profitable one to shareholders. (4–6–12.)

C. A. Ruedeger's Asbestos Show.—Situated in the hundred of Bright, 23 miles N.E. from Eudunda. The property consists of section No. 3A, having an area of 545 acres held under search licence No. 27/13.

Asbestos formations of considerable width appear to traverse this property in a N. and S. direction, the outcrops are prominently exposed at several points along the line of strike where strong seams of blue asbestos are showing, varying in width from 1in. to 3in. wide, and traversing the decomposed country rock in various directions, and from 12in. to 36in. apart, going down fairly vertical.

Near the S.W. corner of section 3A, on top of a hill 60ft. above the plain, a small amount of prospecting work has been done, consisting of a trench 63ft. long and 18in. to 30in. deep, in which several seams and bunches of blue asbestos are disclosed. Some of the veins are fairly defined, and contain fibres over 2in. long, and the rock in places is thickly impregnated with fine particles of blue asbestos. The formation appears fairly wide, and likely to contain a large quantity of asbestos; but until further exploration work has been done in the deposit to a greater depth and along the line of strike, its full extent cannot be determined.

About 10 chains further S. and near the foot of the hill, a pit 12ft. long, 7ft. wide, and from 6ft. to 8ft. deep, has been sunk in asbestos-bearing material, which appears by its trend to be the continuation S. of the formation exposed on the hill. On the N. side of the pit there are several seams of asbestos of various thickness showing in the decomposed rock. The asbestos veins are fairly defined and likely to continue down. The country on the S. side of the pit is hard limestone with thin asbestos veins in the joints and on the face of the rock.

In the creek traversing the S. boundary of the property a large asbestos-bearing formation is outcropping, and consists of soft decomposed slates and sandstone, containing seams and bunches of asbestos 1in. to 4in. wide for a length on the N. side of the creek of fully 60ft. The formation disclosed is fairly defined, and appears likely to traverse the whole length of the block.

About 12 years ago a large amount of work was done in the formation at the point exposed in the creek, and about 16 tons of asbestos material were extracted from the workings and sent to market.

Twelve samples taken from different parts of the property were tested and determined at the School of Mines, and proved that the asbestos is the mineral species (Crocidolite) or blue asbestos of fairly good quality, and when properly cleaned and the fibre separated from the adhering rock particles, would be a good marketable product worth about from £10 to £15.

Judging from what could be seen at the different surface shows inspected the prospects are very encouraging, and the indications are exceedingly favorable that large bodies of asbestos-bearing material traverse the property. The ground enclosing the asbestos veins is fairly soft, and a considerable quantity of material could be extracted by open-cut workings.

Although comparatively very little work has so far been done to develop or determine the extent of the formation, the surface prospects at various points on the property are of highly encouraging nature and fully justify the expenditure of capital in developing and working the deposit on an extensive scale, and with proper plant to treat the crude material, which is soft and of friable nature and could be easily and cheaply treated, the venture would have a reasonable chance to become a highly remunerative one. (12–6–12.)

Utica Copper Mine.—Situated in the hundred of Kooringa, about 6 miles S.E. in a direct line from the Burra Burra Copper Mine.

The property consists of section No. 3, having an area of 633 acres of freehold, and the Utica Copper Mining Syndicate have obtained from the owner of the land a 50 years' lease of the block for mining purposes.

There are several parallel copper-bearing lode formations traversing the property, strike N.W., dip S.W. The outcrops are prominently exposed, and the various lodes can be traced on the surface along the lines of strike for considerable distances. There are also other large outcrops of copper-bearing formations exposed for a considerable distance on the surface bearing N. 20° E. These ore channels are fairly defined, and will apparently at different points junction with the N.W. lodes ; and in most cases where ore channels junction a fairly good deposit of ore may be discovered, because it generally occurs in rich pockets at or near the point of intersection.

The present workings are situated on the side of a hill about 50ft. above the adjacent gullies ; they consist of shallow prospecting pits and open cuts 6ft. to 20ft. deep, and the ore-bearing material disclosed is chiefly quartz impregnated with blue and green carbonates and small bunches of grey ore.

The work at present in progress is the sinking of an underlie shaft in one of the N.W. and S.E. lodes, which is down a total depth of 10ft., the ore body being ferruginous quartz containing blue and green carbonates, and from 3ft. to 4ft. wide.

Two chains further N.E., in the outcrop of a parallel lode showing on surface, a shaft has been sunk to a depth of 9ft. The formation consists of quartz and decomposed rock 4ft. wide, carrying patches of grey ore and blue and green carbonates.

About 3 chains S.W. from the present workings a shaft has been sunk to a depth of 20ft., disclosing lode material 4ft. wide containing blue and green carbonates.

A short distance from the shaft a large amount of prospecting work has been done by open cuts 6ft. to 8ft. deep for a length of 40ft. in lode formation bearing N. 28° E. The ore body operated on consists mainly of quartz containing blue and green carbonates and pockets of grey ore for a width of from 10ft. to 15ft., with no walls showing. It appears a very promising lode, and is well worth being proved to a greater depth. A prospecting shaft should be sunk at one end of the open cut to a depth of from 60ft. to 70ft., and then put in a crosscut through the formation at that level to ascertain the full value and width of the ore body, and also to determine the true dip and bearing of the lode, which information should be obtained, if possible, prior to selecting a site for a main working shaft, as this may save a great amount of trouble and expense in sinking and future working of the mine.

Half a mile E. from the present workings a fair amount of work was done at some previous time on a ferruginous lode bearing N. and S., dipping E. An underlie shaft has been sunk in the formation to a depth of 40ft., showing ore body in the bottom of the shaft from 2ft. 6in. to 3ft. wide, composed of decomposed schist and ironstone, containing copper ore, chiefly malachite.

A short distance E. from the underlie a vertical shaft has been sunk and securely timbered to a depth of about 60ft. This shaft was apparently started with a view of intersecting the ore body at a reasonable depth, and also to connect with the underlie workings for ventilation and other purposes ; but it appears that operations on the mine were suspended before the above work was completed.

Fourteen samples were taken from the various lodes at different points in the workings, and gave on assay—

		Copper.
No. 1	sample from N.W. end of new shaft	5·3 %
No. 2	" " S.E. end of new shaft	6·0 %
No. 3	" " dump from open cut	25·3 %
No. 4	" " dressed ore	42·6 %
No. 5	" " open cut, 8ft. deep	2·5 %
No. 6	" " vein 6in. wide, 8ft. deep	21·7 %
No. 7	" " bottom shaft, 20ft. deep	2·5 %
No. 8	" " dump shaft, 20ft. deep	4·0 %
No. 9	" " dump shaft, 9ft. deep	3·6 %
No. 10	" " dump shaft, 9ft. deep	3·9 %
No. 11	" " dump, new shaft	15·9 %
No. 12	" " dump, new shaft	11·9 %
No. 13	" " bottom underlie, 40ft. deep	7·9 %
No. 14	" " bottom underlie, N. end, 40ft. deep	4·0 %

As shown by the results of the various samples, all the lodes exposed in the different workings appear to contain a fair percentage of rich copper ore, chiefly azurite, copper glance, and malachite, which occurs in small nodules and pockets all through the matrix.

The ore-bearing formations are wide and strong, with every indication that they will continue down to a great depth, and, judging from what can be seen on the surface and in the present workings, the prospects of this property are highly encouraging, and fully warrant the mine being more extensively developed, and exploration work carried on to a greater depth. (17–6–12.)